SCIENTIFIC AMERICAN

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LOSS OF THE CAMPBELL AIR SHIP.

Shortly after 10 o'clock on the morning of July 16, Prof. E. D. Hogan, an aeronaut of considerable previous experience, made an ascent from Brooklyn in the air ship shown in the accompanying illustration. This air ship is the invention of Mr. Peter C. Campbell, of Brooklyn, and had as its most prominent feature an ovoid-shaped balloon, about sixty feet in length, made of fine Japanese silk, imported expressly for the work. Especial interest was felt in this ascension from the fact that it was claimed that the aeronaut would, with the various mechanisms provided, be able to control the movement of the balloon so as to practically navigate the air, moving in any direction with or against the wind, and at a greater or less elevation, as desired, an attainment which had, apparently, been achieved in some brief trials had last year at Coney Island.

The ascent was made from the works of the Nassau Gas Company, where a pipe from a large meter was connected with the balloon to supply the lifting power. The meter showed that 15,027 feet of gas was used, the balloon being filled at about 10 o'clock, when the ropes were tested and some sand bags attached to the network and placed in the car. Shortly after this Prof. Hogan entered the car and gave the word to "Let her go," when the ropes were cut and the air ship shot upward, amid the cheers of a crowd of spectators which had collected in the vicinity. The start was made in a southeasterly direction, owing to a brisk wind from the northwest, although the aeronaut was seen to be vigorously turning a crank which kept the steering apparatus and propelling wheels revolving rapidly, with the evident intention to compel the ship to face the wind. When about a mile distant, the large bottom wheel, intended to raise and lower the ship, became detached and fell to the ground. An hour after the start the air ship was seen to be under full way toward the Atlantic Ocean, on the south side of Long Island, and at an elevation estimated to be several thousand feet. The suspended car and attachments were reported to have had the appearance of being greatly disarranged, and it appeared as though a man was clinging to the netting of the balloon. At 12:30, or about two hours after starting, the air ship vanished from view. From this time the accounts of the voyage of the air ship are conflicting. A New York pilot boat reported sighting a big, yellow, oval-shaped balloon, dragging in the ocean, late in the afternoon of the 16th, 74 miles southeast of the eastern end of Long Island. Chase was given, but when within three-

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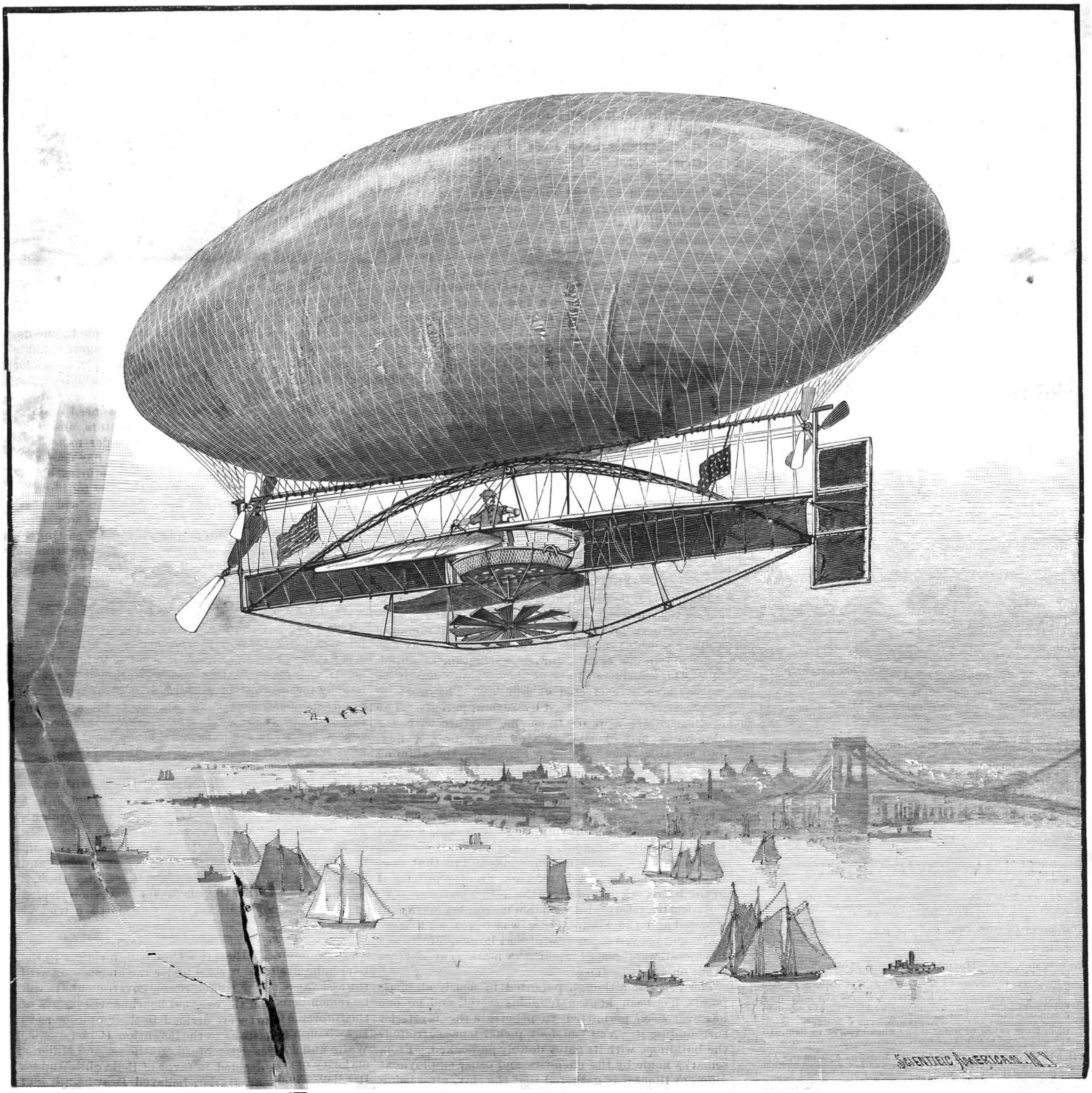

THE CAMPBELL DIRIGIBLE AIR SHIP RECENTLY LOST AT SEA.

Scientific American.

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A FAST AMERICAN STEAM LINE TO EUROPE.

The appearance of a fleet of six or eight great steamships, equal in size and speed to the best British liners and carrying the American colors, would, indeed, be a fine sight!

To build such ships and place them on a line between Fort Pond Bay, Long Island, and Milford Haven, England, has long been talked of; indeed, there is reason to believe, the project was once seriously considered, and, if a recent report may be relied upon, steps are now being actually taken to acquire wharfage and railroad terminals looking toward its development.

Happily there is no talk of carrying heavy cargoes, such as the other liners take, for the transshipment of these by rail, and the extra handlings necessitated, would make the scheme impracticable. The design, it seems, is to build large, light-draught steamers, after the skimming dish pattern as carried out in the lines of the Cunarder America rather than after the long, narrow U so generally adopted. Passengers and fast freight will alone be carried, at least that is what they say; and it is not hard to understand how such steamers, if really able to save twelve hours on this side of the ocean and six on the other, should do a paying business, even with or without the mail contract that their projectors are to ask Congress for. As to the advantages of Fort Pond Bay, which may be said to be just around the corner from Montauk, there cannot be any doubt. A steamer stopping there saves not only a clear run of nearly 130 miles, but as well the delays of entering and traversing a large, shallow, and crowded bay. Milford Haven, on the other side, too, is convenient and near to London.

Up to this point all seems reasonable and practicable. But when it is promised for these American-built ships that they will cross the ocean in 5½ days, or nearly 12 hours faster than the best trip known, in other words, equaling the best speed yet attained, even the most loyal American, if at all informed as to ship designing, will begin to lose confidence. Iron ship building, like most other trades, needs time to learn. The British, getting the germ from us, have been assiduously developing it for more than a quarter of a century, and if, as is alleged in some quarters, we can compete with them in this construction, without undergoing a similar novitiate in the art, we have not, as yet, given any promise of it. Of all the war ships we have built for the new navy there is not one which can compete with their best ships of similar type in point of speed. A recent Secretary of the Navy paid thousands of dollars for the plans of an English fast cruiser, and all we have to represent it is a ship not strong enough to fight or fast enough to get away. In the British fleet are armored ships fast enough to overhaul our unarmored ones. Surely there should be something in what we have done to form a reasonable base for what we propose to ourselves. This proposition being assented to, there is no reason to believe that we can, at least at the present time, build ships to compete in speed with the City of Paris, in the construction of which is combined all the experience and lore that has been gathered by practical shipwrights for a quarter century. Unless we could do this, the proposed American line could scarcely succeed, for it is evident that it could not compete with faster ships, though they traverse a longer road. A fast horse makes a quicker journey than a short lane.

FREDERICK J. SEYMOUR.

Frederick J. Seymour, of Wolcottville, Conn., manager of the American Aluminum Company, at Findlay, O., died there on the 12th instant. He was a man of ability, and his processes for the working of clay and other aluminous earths, for the extraction of aluminum, were considered to be of much value. Extensive works have been erected at Findlay. The processes of Mr. Seymour are covered by several patents. The leading feature appears to be the mixture with the aluminous ores of zinc ores or other ores, a flux, and suitable fuel. Under a high heat the alumina and zinc are vaporized and condensed, from which product the aluminum is afterward separated. Exactly how the separation was effected is alleged to have been a secret known to and practiced only by the inventor. This important item of knowledge, it is said, was not revealed by Mr. Seymour, who was suddenly stricken with paralysis, became unconscious, and in that condition passed away. A letter from Findlay published in the New York *World* gives the following:

Expensive retorts and valuable machinery were constructed and the manufacture was begun on a large scale, and proved so successful that large quantities of the metal were placed upon the market at a large profit on the investment.

The process, although patented in nearly all of its points, has been kept a religious secret, and no one has ever been permitted to penetrate the mysteries surrounding it. A fifteen foot picket fence surrounds the buildings, with its gates doubly padlocked. From remarks made by the chemists and other employes at different times it is gathered that the clay, after being ground in water and treated with various chemicals, is treated to a heat of 1,500 degrees in large retorts, until it has become thoroughly fused. When it has reached the crowning temperature the precious metal is separated from the mass by the addition of a certain chemical in specific quantities, but the name and nature of this chemical is not disclosed in the letters patent, nor has any one employed about the works ever discovered it. It is this secret that has gone down into the grave with F. J. Seymour. It had been his invariable custom to await the critical moment when the fluid mass had reached the right stage, and then all the employes were excluded from the room, the doors were locked, and all alone he went through the mysterious processes of the laboratory, adding a chemical that no one knows the name of, has never seen, and in quantities that cannot even be guessed at.

Patents, Designs, and Trade Marks in Great Britain.

The sixth annual report of the comptroller-general of patents, designs, and trade marks demonstrates a continued increase in the national inventiveness, as well as of the steadily growing appreciation of the value of trade marks. According to the *Ironmonger*, in the year 1888 the total number of patents applied for was 19,103, of single designs 25,923, of sets of designs 316, and of trade marks 13,244, as compared with 18,051, 25,374, 309, and 10,586 respectively in the year 1887. Of the patents, 13,598 were applied for by persons resident in England and Wales, 1,457 by Americans, 1,031 by persons in Germany, 946 by residents in Scotland, and by 702 persons in France. The number of German patentees is so considerable as to excite some surprise. It demonstrates, apparently, that the Germans are becoming much more original than they once had the reputation of being. The fact is significant and worthy of the attention of British manufacturers and inventors. During the year, 568 designs were refused registration, owing to their similarity to designs already registered. For trade marks 513 applications were made to the Cutlers' Company of Sheffield. There were fifty appeals from the decision of the comptroller to the board of trade. Of these six were dealt with and allowed by the board, three were decided against the appellants, and the others settled, abandoned, or remained undecided at the end of the year. Annexed to his report the comptroller gives a balance sheet, which is probably the most interesting feature of the entire document. It shows that the patent fees amounted to £128,588, design fees to £4,922, trade mark fees to £10,234, and sales of publications to £5,878. The total income of the department amounted to £149,623, while the expenses were £83,924, thus leaving a surplus for the year of £65,699, or over 43 per cent of the income. A large surplus is now chronic in the department, consequently there is the strongest possible reason for reducing the fees—at all events, those for patents. A reduction of 25 per cent could be made with perfect safety, and should be made without delay. We cannot afford, and do not need on any grounds, to tax the brains of our inventors, who have to compete with all the world in order to keep us ahead of our rivals. The act of 1883 has doubtless been of great assistance to the manufacturing industries of this country, but it fixed the fees too high, as experience has proved to demonstration, and they ought to be lowered to the extent we have suggested. There would still be an ample margin for contingencies, and any increase of the work of the department which might result therefrom would be more than paid for by the additional fees received.

Coffee in Liver and Kidney Diseases.

It is now more than thirty years since Dr. Landarrabilco called attention in the medical journals to the great value of green or unroasted coffee in hepatic and nephritic diseases. After having continued to use the remedy for upward of a third of a century in many hundreds of cases, he again appeals to the profession, through the *Moniteur de Therapeutique*, to give it a trial in those cases of liver and kidney troubles which have resisted all other treatment. His habit is to place 25 grammes, or about 3 drachms, of the green berries (he prefers a mixture of 2 parts of Mocha with 1 part each of Martinique and Isle de Bourbon coffee) in a tumbler of cold water, and let them infuse overnight. The infusion, after straining or filtering, is to be taken on an empty stomach the first thing after getting up in the morning. He cites many cases of renal and hepatic colics, diabetes, migraine, etc., which although rebellious to all other treatments for years, soon yielded to the green coffee infusion. It is worth a trial at any rate.

IT is announced that the Drawbaugh claims to the telephone are to be revised under the auspices or with the assistance of the United States government. It will be remembered on the original hearing, the judges of the Supreme Court were divided in their opinion as to Drawbaugh's merits as to the invention. Chief Justice Waite and Judges Blatchford, Mathews, and Miller, a majority of one decided in favor of Bell, while Judges Bradley, Field, and Harlan believed Drawbaugh had abundantly proved his case.

POSITION OF THE PLANETS IN AUGUST.

JUPITER

is evening star and stands first on the list during August. He is receding from the earth, and is low in the south, but is the most brilliant of all the stars visible in the evening sky. He makes his transit on the last day of the month soon after 7 o'clock in the evening. Jupiter sets on 1st at 1 h. 43 m. A. M. On the 31st he sets at 11 h. 42 m. P. M. His diameter on the 1st is 42".8, and he is in the constellation Sagittarius.

VENUS

is morning star. She is retracing her steps toward the sun and her luster grows dim, but she is still the peerless gem of the morning sky, pursuing her radiant course for about three hours before sunrise. Venus rises on the 1st at 1 h. 37 m. A. M. On the 31st she rises at 2 h. 9 m. A. M. Her diameter on the 1st is 19".2, and she is in the constellation Taurus.

SATURN

is evening star until the 16th, and then a change occurs. He completes a synodic revolution and comes into line with the sun and the earth, our planet being in the middle. This is called his conjunction with the sun, and takes place on the 16th at 9 h. A. M., Saturn passing to the sun's western side and becoming morning star. Saturn sets on the 1st at 7 h. 48 m. P. M. On the 31st he rises at 4 h. 17 m. A. M. His diameter on the 1st is 15".4, and he is in the constellation Leo.

MERCURY

is morning star until the 7th, and after that time evening star. He is in superior conjunction with the sun on the 7th at 2 h. 47 m. P. M., when he passes to the sun's eastern side and commences his swift course as evening star. As Mercury moves eastward and Saturn westward, the planets meet, making a close conjunction on the 11th, at 9 h. 4 m. A. M., Mercury being 38' north. Mercury rises on the 1st at 4 h. 25 m. A. M. On the 31st he sets at 7 h. 11 m. P. M. His diameter on the 1st is 5"., and he is in the constellation Cancer.

NEPTUNE

is morning star. He is in quadrature with the sun on the 27th at noonday, being 90° west of him. Neptune rises on the 1st at 0 h. 9 m. A. M. His diameter on the 1st is 2".5, and he is in the constellation Taurus.

URANUS

is evening star. He sets on the 1st at 9 h. 59 m. P. M. On the 31st he sets at 8 h. 4 m. P. M. His diameter on the 1st is 3".6, and he is in the constellation Virgo.

MARS

is morning star, and is of no account for terrestrial observers during the month. He rises on the 1st at 3 h. 46 m. A. M. On the 31st he rises at 3 h. 27 m. A. M. His diameter on the 1st is 4"., and he is in the constellation Cancer.

Mercury, Uranus, and Jupiter are evening stars at the close of the month. Neptune, Venus, Mars, and Saturn are morning stars.

Indian Medicine Men and War Dances.

The habits and customs of some of the Western tribes are so little known to the general reader that, perhaps, a description of some of their curious practices may be of some interest. Mr. Paul Beckwith has published an interesting paper on the Dakotahs in the last report of the Smithsonian Institution, and among other things he remarks that the medicine man or high priest is invariably a chief, and although he maintains his sway by the use of mysteries and incantations, nevertheless at times shows a power which is not understood by those outside of the cult or brotherhood, and through a knowledge of the medicinal properties of herbs often performs cures that lead one to believe he is not altogether the charlatan he is represented. His cures are often the wonder of the army surgeons.

An incident in point is cited in the case of an Indian who one day came staggering into camp with his leg horribly swollen from a bite of a venomous snake. The camp surgeon could do nothing for the sufferer, but he was completely cured by the medicine man. Another case is quoted in which a cataract of the eye was cured by inserting brass filings into the affected organ. To impress upon the mind of the patient the divine nature of his medicine, the medicine man adds to the efficacy of his remedy mysterious pantomimes, contortions of the body and features, always to a drum accompaniment. If the patient is affected with a serious ailment, he places a paper or bark figure on the ground, and, while the patient is held over it, he fires a gun, by which act the sickness passes into the image in the ground and is killed by the discharge of the gun. They claim that all this power is received from the Great Spirit, who confers upon them a spiritual medicine so powerful that they can kill at will, resuscitate the dead, and cure the sick. This spiritual medicine is represented by anything that strikes the fancy, as a bunch of feathers, a claw, a bird, or the head of an animal.

When a council is held, a barricade is erected in the form of an ellipse, and a tent is raised at each end of the inclosure, one for the high priests or medicine men and the other for ten men who have been selected to keep order and conduct the ceremony, acting as a sort of police. The high priest, from his seat in the medicine tent, appoints four assistants, one bearing a drum, one a pillow and stick, one a rattle, and the last assisting by grunting. A big drum in the center of the circle is being constantly beaten by several drummers. The high priest then speaks to them of the holy dance which was founded centuries ago, and tells them of the power of the medicine of their ancestors, and warning skeptics not to scoff at them or their craft, as they have the power of thrusting a claw or stone through the body of any one at will, causing instant death. In proof of this assertion, he calls one of his assistants to him and points toward him with the medicine bag, at the same instant puffing at him with his lips, whereupon the assistant falls to the ground apparently senseless. Then the priest salaams to the four points of the compass, and invokes the Great Spirit to aid him and the other members present in bringing the dead brother to life. The drums are then beaten and a frantic dance is begun, when the lifeless form gradually returns to consciousness and spits into his hand a mass of froth and blood, in which is found a claw or a stone. The high priest now dances around the circle, and waving his medicine bag, blows upon some one else, who, in the same manner, falls to the ground senseless. The chief continues, and the "dead men," reviving, assist in shooting others, until the inclosure is full of howling savages dancing, yelling, and shooting each other. The dancing is kept up in the most frantic manner. After a certain length of time the four assistants, who have been trotting around the ring faster and faster, form in line, and after advancing and retreating several times, thrust the instruments into the hands of others who become their successors and then take seats, and now represent the gods of the north, south, east, and west, the high priest representing the Great Spirit, or Wan-kan-tan-ka. When a new member is initiated, he is taken into the council tent for instructions, which are secret. He is then stripped of his clothing, excepting an apron about his loins and moccasins on his feet. He is then painted entirely black except a small red spot between his shoulders. The candidate is exhorted to be good, and is told that his medicine will be correspondingly powerful, and he must also give a feast once a year. If he does not, he will meet with misfortunes, sickness, or death. The candidate now receives the holy claw or stone. The medicine man, approaching him from the east, describes the course of the sun with the medicine bag, and bowing to the four points of the compass, mutters an incantation, and thrusting the bag toward him says, "There goes the spirit." The candidate then falls prostrate, and blankets, skins, ornaments, etc., are thown as offerings over the candidate. At command of the high priest the novice recovers and is presented with the medicine bag, becoming a recognized member of the order. After these ceremonies the feast begins, and the food which has been cooking before the tent of the assistants is distributed among the people. The dance lasts from daybreak to daybreak of the day following, and as these dances are frequently given in winter with the thermometer often far below zero, it may easily be imagined how the candidates must suffer, clad as they are in a coat of paint. It is generally understood that the members of the order have secret signs and passes, but the penalty of exposure is so sure and swift, that none of the secrets are ever divulged. There are well known instances in which indiscreet members have mysteriously but permanently disappeared, at the instance, it is supposed, of the medicine men.

Coal Mining at Cape Breton, N. S.

I remarked that it must be hard, dreary, and not to say dangerous work in the subterranean caverns.

"Ay, and you might say submarine caverns too," was his answer. "For we are now under the waters of the bay, and over our heads a sloop of war could ride safely at anchor."

I must admit to a queer feeling passing over me as he made this statement, but I braced up and went on, and we soon came into the chamber where we saw several miners at work.

They labored together in pairs, each couple having to employ the boy who attends their mule and car, and pay him out of their own earnings, which at the time of my visit were fifty cents a ton for the amount delivered at the foot of the shaft.

Although the coal is very soft and easily broken, yet they are obliged to do a great deal of blasting, the ammunition for which is furnished by the company.

The two men who work together will attack the walls of the cavern about ten feet apart, that is where the vein is wide enough to allow that distance; if not, they separate to the breadth of the vein, and dig in a slit about six inches wide, as high as they can reach and down to their feet, and into the coal the length of their pick handles. Then taking a sort of a hoe made for the purpose they scrape out the pieces and into these seams are placed the powerful cartridges, which in rending the rock asunder enable them further to pursue their incursions into the bosom of the earth.

When we arrived in this last chamber, Thomas and his partner were just getting ready to lay a blast, and when all was prepared for firing we were warned to retreat, which we did until we had placed an angle of the passageway between us and the place of the proposed explosion.

In a few moments Thomas, who had remained behind to fire the charge, joined us, and we awaited the shock, which came in about thirty seconds after we all had reached a place of safety.

Its terrific force created a peculiar sensation upon me, a stranger, as it usually does upon every one. For a moment it seemed almost impossible to catch one's breath, while it produced a deathly faint, sick feeling at the stomach and disagreeable dizziness in the head.

We had to wait a few minutes for the dust to subside and the sulphurous smoke to pass off before we could return to examine the effect of the blast; and when we did enter the chamber, we saw by the light of the little oil lamps several tons of coal lying scattered about the floor, while a huge lump, considerably larger than one of the railway cars, was detached from the wall and stood apart by itself where it had been blown by the explosion.

The first thing that the miners did was to examine carefully the rough sides of the immense hole which had been made, and were well pleased to see that they were still in the midst of a large and rich "pocket."

The temporary rails of the tramway were now laid up to the heap of broken coal and the miners turned to with their shovels and quickly filled the car, when the boy and his mule started off with it to the shaft.

After the car had gone, the two men turned their attention to the large lump, and with drills and sledge hammers proceeded to break it up into pieces that could be conveniently handled.

They had it well smashed to pieces and the broken coal all in a pile by the time the boy returned, and after refilling the car, turned their attention to the hole again, and with picks smoothed off the rough sides and such loose coal as they could get out preparatory to drilling other slits for a second blast.

Where they strike a good "lead" like this, two miners would be able to make about three blasts in two days, or twenty-four hours' labor, and should be able to get out from fourteen to eighteen tons of coal, which it will be seen is far from giving them a just recompense for their arduous and perilous work.

After spending a little more than an hour in this dark and smutty cavern, we retraced our steps to the shaft and in a short time reached the surface, where we again enjoyed a breath of pure, fresh air, and I heartily sympathized with the poor fellows who had to spend the greater part of their lives in that terrible hole.

I wandered about among the houses of the miners; each one had its little patch of ground, with a crop of potatoes growing, and before the doorway of nearly every house were strings of herring, or split cod-fish spread upon racks and drying in the sun.

There was scarcely a man to be seen about, unless it was some aged grandfather who was too old to labor in the mines.

Such a one might occasionally be seen grubbing in the garden or vainly striving to quiet the cries of an infant who had been left to his charge.

It was in most places, however, that women were to be found at the fish "skids" or using the hoe, and they seemed to thoroughly understand, if not enjoy, their labor.—*Boston Com. Bulletin.*

A Steam Carriage.

M. D. Chibout-Flambart, of Vendome, writing to *La Nature*, gives the following description of a steam carriage which has been constructed for him by Messrs. De Dion, Bouton & Trepardeux. The boiler is of the vertical type, 18⅞ in. in diameter and 20½ in. high. In normal working it evaporates 13·3 gallons of water per hour at a pressure of 170 lb. per square inch. The fuel used is coke, which costs about ⅛d. per mile. The water carried is 28¾ gallons, which is sufficient for a run of about 25 miles, the speed attained on fairly good roads with all on, including three riders, being from 12½ to 15 miles per hour. The driving is effected by the two hind wheels, which are worked by independent motors. The weight of the car, fuel, water, and three passengers is about 22 cwt.

Must Use Automatic Couplers.

The bill compelling railroads to equip freight cars with automatic couplers passed by the New York legislature last winter has been approved by the governor. It provides that after Nov. 1, 1892, all steam railroads shall equip all of their own engines and freight cars with "such automatic self-couplers," and that it shall be unlawful after that date to run any of their own cars not thus equipped, except in emergencies. In special cases the railroad commissioners may extend the time one year. The penalty for non-compliance is $500 for each offense.

HINTS ON GLASS BLOWING.

There are few mechanical operations requiring a higher degree of manipulative skill than that of glass blowing. A peculiar sensitiveness of touch and quickness of sight are essential. In many instances whatever is done must be accomplished almost instantaneously. There is no time for deliberation. The operator must know exactly what to do, and then, when the conditions are favorable, he must do it quickly and with certainty.

Fig. 1.—BENDING A GLASS TUBE.

More can be learned by watching an expert glass blower for a half hour than can be acquired by reading the literature of the subject or by days of practice. However, when the principal points are gained, practice will in time lead to proficiency.

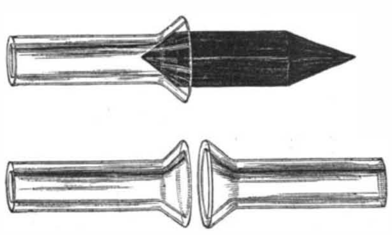


Fig. 2.—WELDING A TUBE.

The bending, perforating, and welding of tubes, the formation of bulbs, tees, funnels, and jets are among the simple operations of glass blowing, with which every worker in physics or chemistry should acquaint himself.

Very few tools and appliances are needed. The most important requisites are a gas blowpipe capable of producing brush and pointed flames, a bellows for supplying air to the blowpipe, some pieces of charcoal having pyramidal ends, corks of different sizes, and a sharp triangular file. A stock of glass tubes of various sizes will be needed. These should be purchased at one place and time, if possible, to insure uniformity in quality. Soft German glass is the most satisfactory. A small tube is divided into lengths by first nicking it with the file, then grasping it in both hands, placing the thumb nail against the glass opposite the nick, and then breaking the tube by such a movement as would be required to bend the tube at the nick, if the material were flexible, at the same time pulling on the tube in opposite directions. The tube breaks off squarely.

Fig. 3.—TUBE FOR FORMING A BULB.

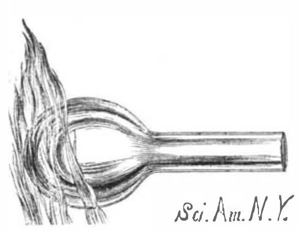


Fig. 4.—FORMING A BULB.

A tube of large diameter is divided by scratching it with a file, then cracking it by applying to the scratch a small point of hot glass, or by means of a hot wire curved to partly encircle the tube.

A small tube is bent by heating it in a brush flame, as in Fig. 1, or in an ordinary gas flame, then curving it as desired. One end of the tube should be corked before it is heated. If it is made too hot, or heated unevenly, it will be impossible to give it a true curve.

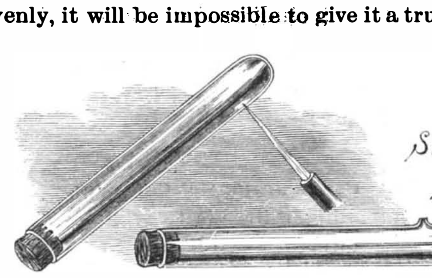


Fig. 5.—PERFORATING A TUBE.

If the tube becomes flattened in bending, or if the curve is not true, it may be carefully reheated at the defective points, and corrected by bending, or by blowing into it.

Tubes are welded by first flaring them as shown in Fig. 2 by introducing the pyramidal end of the charcoal into the hot end of the tube and turning it, or by turning the tube on the charcoal with a pressure strong enough to give the end of the tube the desired form. The flared ends of the two tubes to be welded are heated simultaneously in the brush flame and joined while quite soft. A pointed blowpipe flame is used to give the joint the desired form. The joint is made true by constantly turning the tube.

A bulb is formed on a tube by first heating it and drawing it out as shown in Fig. 3, then heating a short length of the tube within tapered end and thickening it by pressing upon the ends of the tube. Then another short length is heated and thickened in the same way, and so on until enough material has been accumulated to form a bulb of the required size and thickness. The tube must be continually turned during these operations to cause it to heat evenly, and if it tends to collapse, it should be blown. The mass of glass is now heated evenly throughout and blown until the bulb is of the required size, the rotation of the tube being continually maintained to prevent the bulb from being distorted by its own weight.

The blowing should be accomplished by means of a series of short puffs, rather than by one long blast.

A tube may be perforated by stopping the ends so as to inclose a body of air, then warming it gradually to prevent breaking, finally directing a pointed blowpipe flame upon it where the perforation is desired. The expansion of the air contained in the tube will push out the softened glass and make the perforation. When a tube is thick and of very small diameter, the expansion of the contained air is insufficient for this purpose, and blowing is resorted to.

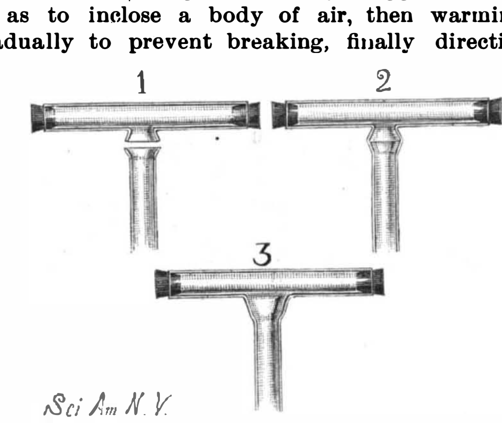


Fig. 6.—FORMING A TEE.

Tees are made by perforating the tube as shown at 1, in Fig. 6, then welding on the branch as at 2, finally heating the joint so as to give it the form shown at 3, blowing into it occasionally if necessary to give it the required form. The ends of the branches of the tee are smoothed and rounded by heating them in the brush flame until they begin to fuse. To prevent breaking, the glass should be allowed to cool slowly, while protected from draughts of air.

To seal a platinum wire in a glass tube, the glass is heated by means of a pointed flame, at the same time the end of a platinum wire is brought into contact with the heated part. The wire welds to the glass, and when pulled away forms in the glass a small tubulated aperture into which the wire is inserted (Fig. 7). When the glass around the wire is heated, it becomes welded to the wire, thus forming a perfectly sealed joint.

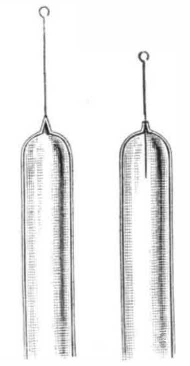


Fig. 7.—SEALING IN A WIRE.

When a particularly good job is desired, some easily melted enamel may be fused on the glass around the wire.

For full information on this kind of glass blowing the reader is referred to "The Methods of Glass Blowing," by W. A. Shenstone, which is a small but comprehensive work on this subject.

American Engineers Abroad.

Some thirty American engineers were entertained very elegantly the other day in Paris by M. Eiffel, of the tower fame. Speeches were made and recorded by a graphophone, unknown, it is said, to the speakers.

The instrument has been sent back to this country, and at the next meeting of the Society of Engineers, in this city, the speeches made at the Eiffel entertainment will be repeated. In Germany they have met with the most cordial treatment and, as one of our exchanges says, their trip has been one constant ovation. In passing along upon the Rhine warm greetings were extended to them, and at Coblenz, the home of the aged Dowager Empress Augusta, the Empress herself extended to the party the most cordial hospitality, first granting them an audience, and then inviting them to lunch with her on the beautiful terrace of her glorious old castle. On the following day the party was given a steamboat trip on the Rhine as far as the Drachenfels Mountain, and on their arrival there in the evening found the heights in the vicinity and on both sides of the river illuminated in honor of their visit.

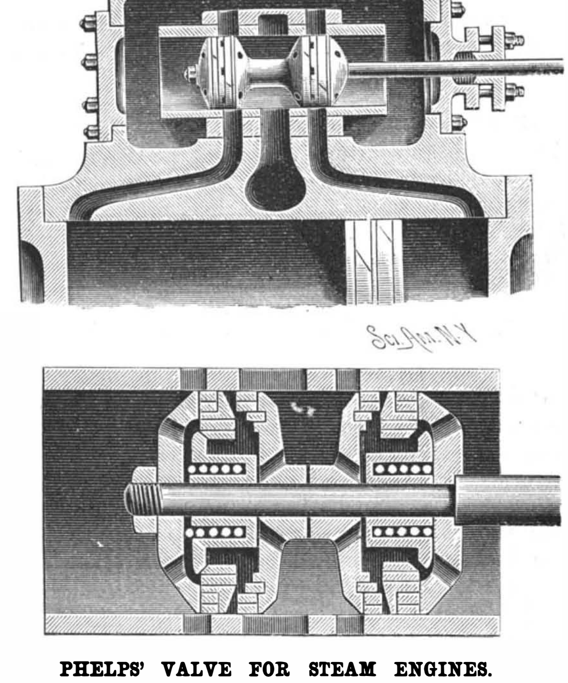
English Capitalists Buy a Patent.

In the SCIENTIFIC AMERICAN of March 9, 1889, there was illustrated and described a remarkable machine, which had been in use in the New York *Tribune* office for two years for composing matter. It is not a type-setting machine, but forms type bars, each of the length, width, and height of a line of type, and an exact counterpart of that which a compositor would set up. After the engravings had appeared in this paper they were extensively copied abroad, and now we learn that Mr. James Marix, connected with the London *Financial Times* and owner of the *Whitehall Review*, came over from London with a party of English capitalists a short time ago, and after examining carefully into the merits of the machine and becoming satisfied of its practicability, they have purchased the patent rights for the whole world, the company retaining only America. The cost approximated $500,000. In an interview with a reporter on one of our daily papers, Mr. Marix said his party numbered twenty-five persons, representing $50,000,000 of capital. We bought, he adds, a number of breweries in Duluth and Buffalo, and several granaries in Chicago. All these purchases were made on options for an English syndicate.

To any of our readers who have breweries, granaries, or patents they would like to exchange for British gold, and would like to learn the address of Mr. Marix that they might correspond with him, we know no better way to reach him than to address at the *Financial Times* office, London. Mr. Marix and his associates have left these shores and returned to England.

AN IMPROVED VALVE FOR STEAM ENGINES.

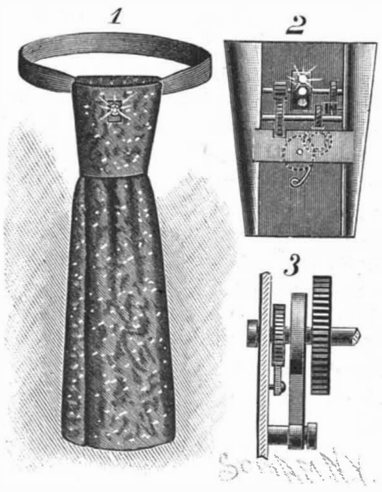
The accompanying illustration represents a valve which has been patented by Mr. Walter S. Phelps, of St. Catalina Guantanamo, Cuba, and is designed to obviate excessive compression in the steam cylinder and destroy the strong suction caused by vacuum created in the valve chamber. Fig. 1 is a side elevation, partly in section, of the valve and its casing, and Fig. 2 is a longitudinal sectional elevation. The invention consists principally of a relief valve held seated by a spring, but exposed at the opposite side to the pressure of the steam, so that in case of excessive pressure, suction, or vacuum, the engine being in motion and steam shut off, the valve will lift, and steam or hot vapor and gases will enter and destroy compression and vacuum, by way of the apertures under the valve leading to the exhaust, as well as by the opening directly into the steam pipe through the piston valve, thereby giving free openings from the steam pipe direct to the atmosphere through the exhaust pipes. The valve casing is formed with numerous steam ports, and the valve is composed of two similar heads or pistons, each formed of a circular plate with a rim parallel with the piston rod and a vertical flange, there being openings through the plate and through the rim. The relief valve is fitted within the rim and held to its two seats by a coiled spring held in contact with the valve by a large circular plate on the piston rod, which also holds the packing rings and an outer ring firmly against the flange of the body of the valve. One seat of the relief valve covers holes leading to the exhaust, and the other seat, upon its outer rim, covers the passage leading into the steam pipe and chest, the unseating of the valve opening all connecting passages through the piston head, including passages from the throttle to the escape pipe or atmosphere, simultaneously.



PHELPS' VALVE FOR STEAM ENGINES.

AN IMPROVED NECKTIE.

The accompanying illustration represents a necktie constructed upon a shell which contains a removable ornamental wheel, with means for operating the wheel, so that portions thereof will be visible from the front of the shell at intervals. The shell is covered with material corresponding to the apron, and is of thin metal, such as tin, bent to the shape of the tie. It has at its back a cross bar, as shown in Fig. 2, above which are journaled shafts, on one of which is a wheel or disk, on which is rigidly secured a series of gems, there being in the front face of the shell an aperture or opening for displaying one gem at a time. This wheel or disk is adapted to be revolved by a coil spring, and by mechanism inclosed in the shell, Fig. 3 showing a detail of a pawl and ratchet forming part of such mechanism. The wheel is made to turn slowly to register with the opening in the front of the shell, but the speed with which it turns may be regulated by an escapement embodied in the device. A shaft terminating in a button projecting from the shell affords a ready means for winding the spring.

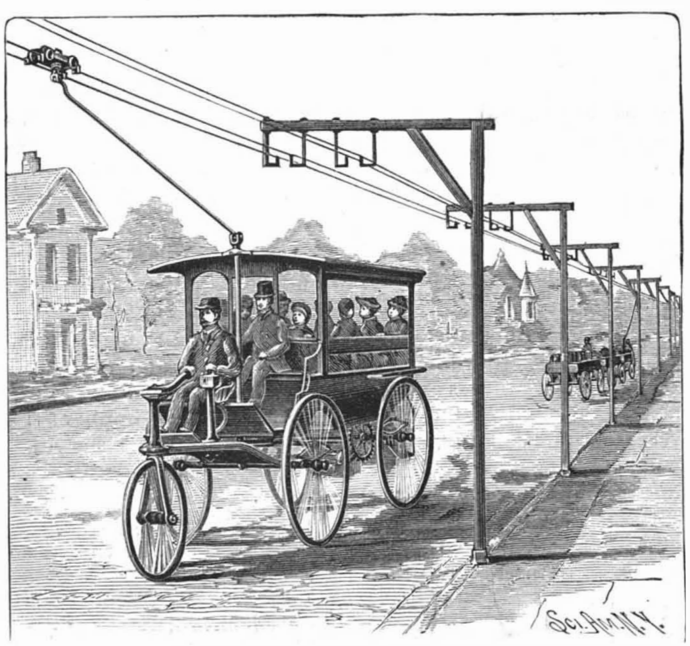


HOWARD'S NECKSCARF.

For further information relative to this invention address the patentee, Mr. E. T. Howard, in care of C. & W. I. Depot, corner of Stewart and Archer Avenue, Chicago, Ill.

ELECTRIC PROPULSION FOR COMMON ROADS.

The accompanying illustration represents the application of a system of electrical propulsion for common roads, by means of which traffic is designed to be carried on without employing a railroad track, the steering gear being so arranged that the wagon will automatically run parallel with the line of the conductors. It has been patented by Mr. Harvey D. Dibble, of Rapid City, Dakota Territory. The wagon body to which this improvement is applied is partly supported on a caster wheel, provided with a fork, journaled in the forward end of an extension of the frame of the body. Upon the rear axle, in this case carrying the drive wheels, is mounted a spur wheel engaged by a pinion on the armature shaft of a motor secured to the main frame of the body. Above the road bed are suspended electrical conductors, supported by poles and brackets, and each wagon is provided with a trolley which rides upon a pair of the conductors, whereby connection is made between the motor and conductors, through a vertical shaft, the electrical switch being close to the driver. The driver's seat is supported on the forward extension of the body, where he is able to guide the wagon by turning the caster wheel in one direction or the other. Ordinarily the wagon will run in a line parallel with the conductors, the trolley following any deviations from a straight line, and the driver not being required to use the steering lever except when it is needful to turn aside, when the wagon can be made to run in a new line according to the position in which the driver places the steering lever. The yielding nature of the connection between the wagon and the trolley is such as to permit one wagon to turn out for another upon the road, or permit a wagon to run continuously on one side of the conductors. A wagon of this description, having an electric motor of sufficient capacity, may also, beside scarrying its own load, draw a train of other loaded wagons.


DIBBLE'S ELECTRICALLY PROPELLED CARRIAGE.

Edison's Home Life.

Thomas A. Edison, while in Pittsburg recently attending to his patent suit with Westinghouse, was interviewed by a *Dispatch* reporter, to whom he revealed some of the characteristics of his mode of living:

Yes; I am a hard worker. I hardly ever sleep more than four hours per day, and I could keep this up for a year. Sometimes I sleep ten hours, but I don't feel well when I do. If I could sleep eight hours, as most men do, I would wake up feeling badly. My eyes would hurt me, and I would have a tough time to keep awake. I inherit this from my father. He is a remarkable old man, eating little and sleeping less. I have often known him, when I was a boy, to sit up all night talking politics with a friend or swapping stories.

I eat about a pound a day, and my food is very simple, consisting of some toast, a little potato, or something of that kind. You know when I am working on anything I keep at it night and day, sleeping a few hours with my clothes on. I never take them off; don't even wash my face: couldn't think of such a thing, and in this condition I take my meals. If I were to remove my clothes when I slept, I would get up feeling out of shape and with no desire to go to work. "No. 6" is my den in the laboratory, and I shut myself in there and hustle.

I sleep from 1 to 6 in the morning, and then I jump up and go to work again as fresh as a bird. This is all the sleep I need.

But I tell you we have lots of fun in the laboratory. Some time ago I had forty-two men working with me on the incandescent lamp in a big building. I hired a German to play an organ for us all night, and we worked by the music. About 1 o'clock a farmer brought in our lunch, and we ate from a long table. At first the boys had some difficulty in keeping awake, and would go to sleep under stairways and in the corners. We employed watchers to bring them out, and in time they got used to it. After a while I didn't need forty-two of them, and I discharged six of them. Well, do you know, I couldn't drive them away. They stayed there and worked for nothing.

Oh, we enjoy this kind of life! Every now and then I hire a big schooner, and we go down the bay, my men and myself, to fish for a few days. Then we come back and buckle down to it again.

AN IMPROVED HARNESS.

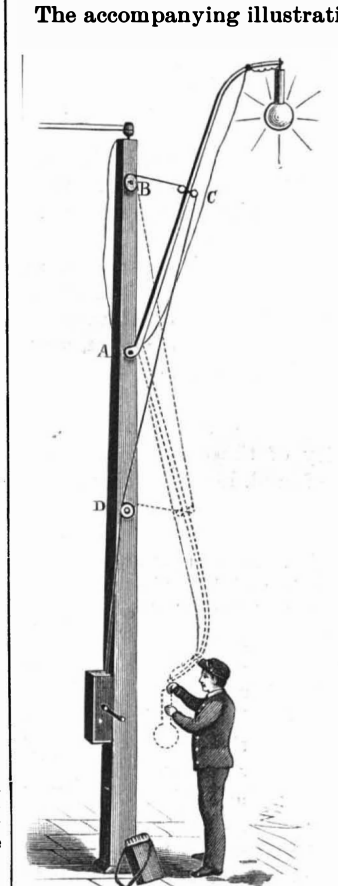
A harness by means of which the vehicle will be pushed instead of pulled is illustrated herewith, and has been patented by Mr. Isaac J. Gray, of Beloit, Wis. The small figures represent a pusher bar and one section of a harness, disconnected, together with a face view of a doubletree and the singletrees it carries, as they appear when removed from the forward end of the pole. The ends of the singletrees are shaped to enter eyes in the forward end of pusher bars, the rear ends of which have hinged sections which enter housings formed on pads through which the bars pass, the under side of the bars having notches entered by shackles pivotally connected to arms pivoted to the harness section, the shackling entering either of the notches as desired to bring about the proper adjustment of the harness. The inner pushers, or those adjacent to the pole, are preferably made in one solid piece, and, that the horses may be held from traveling too far apart, these pushers are connected by a strap. This harness may also be used with the ordinary form of Dutch collar, the pushers being connected to the rear ends of the collar, and can be employed with a single harness, in which case a cross bar would be connected to the forward ends of the thills, and a singletree pivotally connected to the cross bar.

Silvering Glass.

The following, by M. Bory, for silvering mirrors is a very simple and efficient process. The plate of glass is first carefully cleaned and laid on a perfectly level table, which must be kept at a temperature of 25 deg. to 30 deg. Cent. To silver a plate of 1 square meter two liquids are prepared, the first consisting of 10 grammes of double tartrate of soda and potash dissolved in 1 liter of distilled water, and the other of 5 grammes of nitrate of silver dissolved in 3 grammes of pure ammonia and diluted with 1 liter of water. The two liquids are then intimately mixed, and a small portion of the mixture is spread evenly over the glass, when the remainder is poured on. In the course of 30 or 40 minutes the silver is precipitated in its metallic form, and adheres closely to the glass, which need only then to be freed by tilting from the superfluous fluid, slightly rinsed with water, and placed upright to dry. A coating of varnish is afterward applied with a brush to protect the mirror from damage and the action of the air.

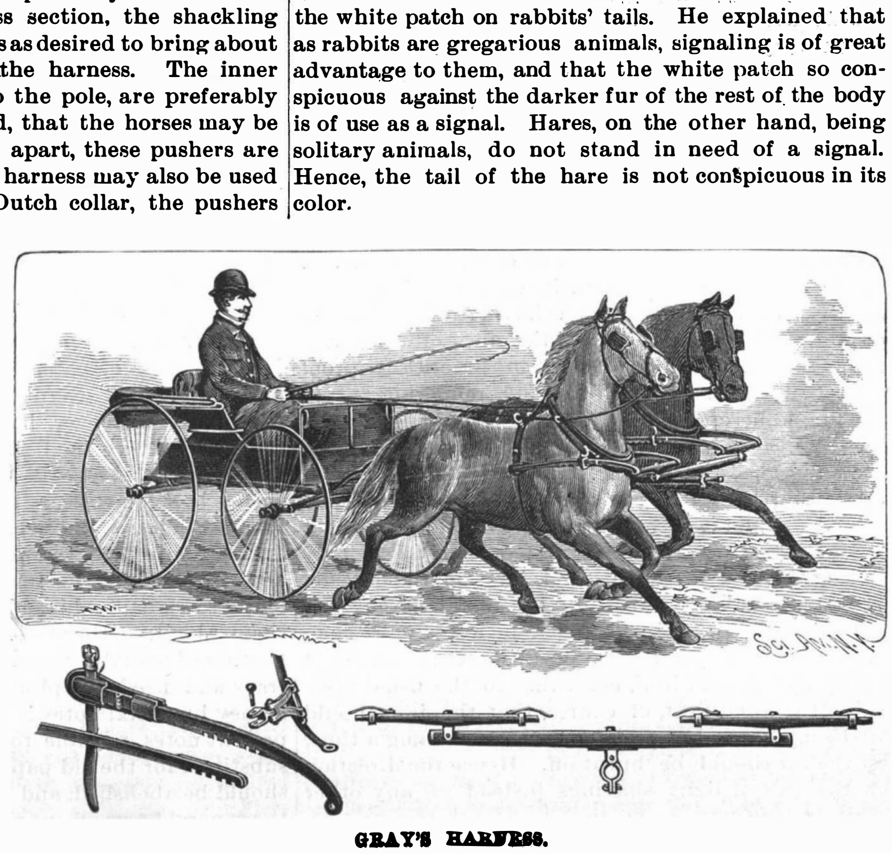
ELECTRIC LAMP HANGER.

The accompanying illustration gives another view of an electric lamp hanger described in the SCIENTIFIC AMERICAN a few weeks ago, and which has been patented by Mr. John Bucksey, of Ottawa, Canada. The position of the lamp when lowered for cleaning, etc., is shown in dotted lines, the operator, to effect this, unlocking a box containing a windlass at the foot of the post, inserting a crank, and unwinding a drum to which the endless cable, B C D, extends, and on which it turns. The iron arm carrying the lamp is forked, and is hinged to each side of the main post at A, the electric wires leading from insulators at the head of the post to insulators at the hinge, and thence along the arm to the lamp, thus allowing the lamp to be raised or lowered without tension or slackening of the wires, and permitting it also, if desired, to be raised, lowered, or locked in any position without being extinguished.



Blind Fish.

At the Royal Institution, Professor Ray Lankester accounted for the absence of eyes in the fishes in the famous underground Kentucky caves in the following way: A great flood carries to the bottom of the Kentucky caves, some thirty miles below the surface, a number of fish, among whose numerous offspring will be some defective in sight, as some babies are born blind, or without any eyes at all. The fish who can see some faint glimmerings of light will swim away toward that light, while those will remain that cannot perceive the gleams. This with every succeeding generation would occur, the stronger in sight swimming away and the weaker remaining, and as the breeding would therefore occur between those of the worst sight, fish would be born with weaker eyes and weaker until born blind. The Professor also accounted for the white patch on rabbits' tails. He explained that as rabbits are gregarious animals, signaling is of great advantage to them, and that the white patch so conspicuous against the darker fur of the rest of the body is of use as a signal. Hares, on the other hand, being solitary animals, do not stand in need of a signal. Hence, the tail of the hare is not conspicuous in its color.


GRAY'S HARNESS.

The Priority of Chinese Inventions.

A writer in the *North China Herald* of Shanghai, referring to the Chinese claims to have originated many modern Western scientific inventions, says that Chinese patriotism has exhibited itself in an ardent desire to claim priority over Europeans in this respect. They are a very ingenious people, and, in past times having invented many valuable implements, it has always seemed to them a fair hypothesis that as every machine is an improvement on something that preceded it, the machinery and telescopes of the West may have originated at first in something Chinese. Yuen-yuen, a former Governor-General of Canton, in his "History of Astronomers," written at the beginning of this century, again prominently brought forward the idea that European mathematics came from China, and many subsequent writers have made the same claim. Not only is this the case in mathematics, but the Chinese say our telescopes, steam engines, fire arms, and cannons are owing to them. Ever since China first saw steamers, fifty years ago, and since she came to know of the existence of European mathematics three hundred years ago, she has, from time to time, with more or less eagerness, shown herself bent on claiming that the knowledge and skill shown in the West began in the first place with China.

Mei-wen-ting, a great Chinese scholar, who died at an advanced age in the year 1722, after considering the whole question from the Chinese point of view, came to the conclusion that Europeans got their mathematics and science from China. Among other reasons for this belief he states that in the "Chon-pi," a mathematical work of about B. C. 1100, although not expressly stated, the rotundity of the earth is implied. In the same book are to be found, he says, the properties of a right-angled triangle, as, for instance, that the square of the hypotenuse is equal to the sum of the squares of the other two sides. Since this is a fundamental problem, Mei-wen-ting claims that Western geometrical and trigonometrical knowledge is due to China. He accounts for the spread of Chinese astronomy to us by the scattering of the schools of astronomy in China, which, according to Szu-ma-chien, an historian who wrote a century before the Christian era, took place about B. C. 760. The fugitive astronomers, flying from the tyranny of the early Chow dynasty, diffused Chinese learning among the barbarians. Similarly in other matters the Chinese claim that the metaphysics of Indian Buddhism are due to the journey of Lao-tse to the West. The writer concludes his interesting discussion as follows:

"We need not trouble ourselves much respecting the Chinese claim to have originated Western science; they only claim to have started the preliminary ideas. As to the Chinese having always had enlightened views on many scientific and political subjects, we may frankly admit it. They speak 2,200 years ago of concave and convex mirrors being able to magnify objects.

"Four thousand years ago they had instruments for observing the stars. In the year A. D. 1122 they made use of the magnet pointing to the south on board ship to guide the vessel on her course.

"With the proviso that they may have derived some of their early knowledge in these things and in others, such as the manufacture of fireworks, from foreign countries, these and many like facts we may allow. But we would be glad for them to study the history of Western inventions, and show a willingness to recognize the ingenuity, knowledge, and intellectual power of other nations wherever they are found. Let them also enter on a rivalry in inventions. Let them make new discoveries and advance in the arts in new ways such as may be of benefit to the world. The Western nations will not be slow to acknowledge any efficient aid they may give in science, politics, or the arts."

To Keep Iron Pipes from Rusting.

A simple and economical way of tarring sheet iron pipes to keep them from rusting is the following, suggested by a correspondent of the *Gas Light Journal*: The sections as made should be coated with coal tar and then filled with light wood shavings, and the latter set on fire. It is declared that the effect of this treatment will be to render the iron practically proof against rust for an indefinite period, rendering future painting unnecessary. In proof of this assertion the writer cites the example of a chimney of sheet iron erected in 1866, and which, through being treated as he describes, is as bright and sound to-day as when erected, though it has never had a brushful of paint applied to it since. It is suggested that by strongly heating the iron after the tar is laid on the outside, the latter is literally burnt into the metal, closing the pores and rendering it rust proof in a far more complete manner than if the tar itself was first made hot and applied to cold iron, according to the usual practice. It is important, of course, that the iron should not be made too hot, or kept hot for too long a time, lest the tar should be burnt off. Hence the direction for the use of light shavings instead of any other means of heating.

Business Success.

The question has often been asked, Why does one man succeed in business and another man fail? If one has a due regard for history, it would perhaps be nearer the truth to ask, Why do three men succeed in business and ninety-seven fail? In so far as the manufacturing business is concerned, the agents of the Westinghouse Machine Company have recently been making some investigations that at least afford a clew to the answer. *Practical Electricity* says: In order to obtain statistics, for use in their catalogues, this company sent experts, fully equipped with the necessary instruments, to visit a number of the most prominent manufacturing establishments in the country, where permission was asked to test the consumption of power by each machine. As a rule this was readily obtained from the owners, they seeming much interested in the results. It is only necessary to indicate a few of the results obtained, to make clear the point aimed at. Nearly all were wasting one-half of their engine power (or one-half of the daily consumption of fuel) before commencing actual work, the product from which constituted the maintenance of the business. One prominent establishment was wasting 65 per cent of its fuel and power; another was wasting 73 per cent, thus leaving only 27 per cent of the engine's power to earn money with. Another celebrated firm (known all over the West) was using a sixty horse-power engine, of which fifty-five horse-power was being consumed in dead work, thus leaving just five horse-power with which to produce goods for sale, without overtaxing the engine. It is an "up-hill" business to make money in manufacturing, under such circumstances. Sensible people should be more economical. What is the use of economizing in wages and in the cost of raw materials, when such reckless waste as above indicated is permitted in many of our most prominent establishments?

Few people in this country seem to realize the amount of money that can be wasted in a year through the steam pipe. The proverbial "rat hole" will not compare with it. The manufacturer who has learned to economize at the steam pipe has learned one of the most important secrets of success.

Need for Improved Post Office Service.

The United States post office is retarded in the work of establishing low rates for postage by the distances its service is compelled to cover. It is not just to compare it with the English post office, which has so small and so densely populated an area for its work. Yet a strong desire exists to see the United States rates lowered, and the operations assimilated to the most advanced plans.

Two improvements are especially open to advocacy, one is the reduction of letter postage to a one cent rate, the other is the establishment of a parcels post. Both of these advances would be popular in every sense, and would be in the line of modern tendencies. The Federal government maintains itself in a monopoly for all postal business. The absolute duty of the department therefore is to furnish the best possible service at the lowest possible rates. In England the parcels post has attained a great development. Bundles of merchandise of all descriptions are forwarded at very satisfactory rates, and the people are spared the benefits of a combination or trust among ostensibly rival express companies. A good parcels post in the United States would meet the wishes of an immense constituency, it would facilitate business, and do much to encourage trade of all sorts.

In like manner the one cent rate for letters would be welcomed by all. The present limit of weight for a single stamp is perfectly satisfactory. A letter rarely requires weighing now, while a few years ago correspondents were in perpetual fear of passing the old half ounce limit without knowing it. As the weight limit is so well adjusted, the further adjustment of rates to one cent per ounce is wanted. The post office is like the patent office in one respect. It is instituted to serve the public and not to make money. The patent office turns a large sum of money, representing profits, into the treasury every year. This is wrong. The money comes from the inventors of the country, and should all be spent in facilitating and expediting the granting of patents. The same applies to the post office. The instant it shows a profit, it exceeds its functions. Moreover, in a country developing with such rapidity as the United States, a small loss is not to be considered an evil. Even if the new rates caused such a loss, a few years later it would disappear and the post office would begin to show a profit.

The above are two much needed improvements, and the present Postmaster-General could not do more to signalize his administration than to bring them about. Other reforms are needed. The classification of mailable matter is very confused and arbitrary and needs simplification. The transmission of money by postal notes is open to improvement. The present notes, payable to bearer, are but an imperfect substitute for the old paper fractional currency. They should be abolished, and if a substitute is needed, then the general government could bring out a special issue of fractional notes, which would be a legal tender. The want of this status makes the present notes inconvenient, while their payment on demand precludes any element of safety in their use.

The Canal of Joseph.

How many of the engineering works of the nineteenth century, remarks *Engineering*, will there be in existence in the year 6000? Very few, we fear, and still less those that will continue in the far-off age to serve a useful purpose. Yet there is at least one great undertaking conceived and executed by an engineer which during the space of four thousand years has never ceased its office, on which the life of a fertile province absolutely depends to-day. We refer to the Bahr Joussuf—the canal of Joseph—built, according to tradition, by the son of Jacob, and which constitutes not the least of the many blessings he conferred on Egypt during the years of his prosperous rule. This canal took its rise from the Nile at Asiut, and ran nearly parallel with it for nearly two hundred and fifty miles, creeping along under the western cliffs of the Nile valley, with many a bend and winding, until at length it gained an eminence, as compared with the river bed, which enabled it to turn westward through a narrow pass and enter a district which was otherwise shut off from the fertilizing floods on which all vegetation in Egypt depends.

The northern end stood seventeen feet above low Nile, while at the southern end it was at an equal elevation with the river. Through this cut ran a perennial stream, which watered a province named the Fayoum, endowing it with fertility and supporting a large population. In the time of the annual flood a great part of the canal was under water, and then the river's current would rush in a more direct course into the pass, carrying with it the rich silt which takes the place of manure and keeps the soil in a state of constant productiveness.

All this, with the exception of the tradition that Joseph built it, can be verified to-day, and it is not mere supposition or rumor. Until eight years ago it was firmly believed that the design has always been limited to an irrigation scheme, larger, no doubt, than that now in operation, as shown by the traces of abandoned canals and by the slow aggregation of waste water which had accumulated in the Birket el Querun, but still essentially the same in character.

Many accounts have been written by Greek and Roman historians, such as Herodotus, Strabo, Mutianus, and Pliny, and repeated in monkish legends or portrayed in the maps of the middle ages, which agreed with the folk lore of the district. These tales explained that the canal dug by the ancient Israelite served to carry the surplus waters of the Nile into an extensive lake lying south of the Fayoum, and so large that it not only modified the climate, tempering the arid winds of the desert and converting them into the balmy airs which nourished the vines and the olives into a fullness and fragrance unknown in any part of the country, but also added to the food supply of the land such immense quantities of fish that the royal prerogative of the right of piscary at the great weir was valued at $250,000 annually. This lake was said to be 450 miles round, and to be navigated by a fleet of vessels, while the whole circumference was the scene of industry and prosperity.

The French Exposition.

A writer in *Science* thinks the great exposition lacks novelties. He says people may walk until they are fatigued through the almost endless buildings on the Champ de Mars, and yet fail to find any great and striking object by which they would especially remember the exhibition of 1889. The place is filled with evidences of untiring industry and skill on every side, but there is a strange absence of great novelties. We believe, however, that the exhibition will be famous for four distinctive features—in the first place, for its buildings, especially the Eiffel tower and the Machinery Hall; in the second place, for its Colonial Exhibition, which for the first time brings vividly to the appreciation of Frenchmen that they are masters of lands beyond the sea; third, it will be remembered for its great collection of war material, the most absorbing subject nowadays, unfortunately, to governments, if not to individuals; and, fourth, it will be remembered, and with good cause by many, for the extraordinary manner in which South American countries are represented. Several of those nationalities are beginning to put themselves forward as appreciable factors in the politics of the world, and, what is of more interest to the manufacturer, they constitute the richest and largest customers in European and North American markets. Especially this is the case with regard to agricultural machinery of all kinds, and those exhibitors are fortunate who are well represented in this respect.

Correspondence.

Sugar as a Remedy for Boiler Incrustations.

To the Editor of the Scientific American:

Reference has been made by several scientific papers, your own among the number, to the experiments of an Italian engineer, who claims to have discovered that sugar is an efficient means of preventing boiler incrustations. As many engineers may be inclined to try his plan, it may be worth while to point out that while sugar does undoubtedly act on the incrustation, it dissolves off as much iron as it does scale. To such an extent is this the case, that great difficulty has been experienced in carrying sugar in iron ships, on account of the rapid corrosion. Any iron parts of sugar-working machinery are rapidly dissolved.

The action seems to be as follows: Sugar attacks the iron, with extreme rapidity in contact with air, ferrous iron being dissolved. This absorbs oxygen from the air and is precipitated as ferric oxide, and the sugar is free to attack the iron again. A very small quantity of sugar will thus corrode deeply a large plate of iron.

It would be interesting to know if the Italian engineer's experiments were continued for any length of time. I have not the slightest doubt that his tubes were perfectly clean, but I would like to know how much boiler was left. REGINALD A. FESSENDEN.

Cattle Branding.

To the Editor of the Scientific American:

In your issue of June 25, I see an article headed "Cattle Branding," in which is described the mode of branding in this country. It also says the pain is severe. Now, in Queensland, Australia, which is one of the largest cattle-producing centers in the world, they have a plan which does not knock the stock about, and I am sure that the *brand* does not cause any severe pain. In Australia the edge of the brand is sharp, like the edge of a dull knife, and very hot. It is allowed to rest very lightly on the skin, and only so long as to just whiten the skin. A clean cut ridge of hair grows where the brand has been, and there are *no* disfiguring marks. Three men and a lad of sixteen altered, branded (a figure and a letter), and ear-marked 60 calves per hour, which speed shows that there was no time to roughly handle them. I was years in Australia, and was one of three men (stockmen). I have on one or two occasions burnt myself until the skin turned ashen, which I think was in my case equal to the wound on the calf's hide, and the pain did not last longer than an hour or two.

I can furnish a full description of the way in which the cattle are managed on the open range. (The open range is the only way they have of managing cattle in Australia, when the business is followed on a large scale.) Also a plan of yards and hall in which the cattle are driven when they have to be *handled*.

JOHN T. WRIGHT.

Hillsboro, Washington Co., Oregon, June 22, 1889.

Notes Relating to Hose Pipes.

Mr. J. R. Freeman, of the Associated Factory Mutual Insurance Companies, of which Edward Atkinson is president, has been making very careful experiments on fire hose for mills, and the result is something that all mill owners should know. He found the loss of pressure on a 100 foot length of the roughest cotton or linen hose was about 26 per cent, while in a piece of the smoothest cotton hose it was 14 per cent; in other words, with a hydrant pressure of 65 pounds and a nozzle with 1⅛ outlet a 50 foot length of rough hose would discharge 255 gallons per minute and the smooth hose would discharge 272 gallons per minute; and in a length of 500 feet, with the same pressure, the rough hose would discharge 147 gallons per minute and the smooth hose 185 gallons per minute.

These tests prove it would be advantageous to buy the smoothest hose, for in case of a fire 20 per cent more water could be thrown on a fire with it than with rough hose, and it is now becoming known to firemen that it is the volume of solid water concentrated on the fire which is most effective, and is not converted into useless steam.

Looking at the question in another aspect, we find that with a line 500 feet long of rough hose, a pressure of 65 pounds on the hydrant would throw a solid, effective stream 28 feet high. With a smooth hose and same pressure, the stream would be 42 feet high, a clear gain of 14 feet. This gain oftentimes might mean the saving of a good many thousand dollars' worth of property.

The results of these tests prove that, for mill yard use, a rubber-lined hose of medium weight is preferable to a heavy-jacketed hose used by city fire departments, as it is lighter to handle, less liable to mildew, and costs less. Among the samples tested, the O. K. brand, made by the Boston Woven Hose Company, of Boston, had the smoothest interior under pressure of any hose tried, and they have, therefore, given this hose their preference, as it is made especially to meet their requirements.

They also tested linen hose very thoroughly, which is often desirable for inside use, on account of its superior lightness, compactness, and the convenience with which it can be used by a single man. From their investigations they decided to make the following requirements for all their mills.

1st. That the hose shall not burst at a pressure of less than 400 lb. to the square inch while under pressure for twenty minutes.

2d. That after being wet at a pressure of 75 lb. and thoroughly dried and again subjected to a pressure of 75 lb., the total leakage of the first minute shall not exceed ⅛ of a gallon per foot in length, and that upon this second trial, after the hose has been wet for five minutes, the total leakage during the next five minutes shall not exceed 0·01 gallon per foot in length; the water pressure meanwhile being 75 lb. per square inch.

3d. The hose shall be made of first quality yarn, spun by a first class manufacturer.

Progress of the American Sugar Industries.

BEET SUGAR.

During the past year large capital has been attracted toward the development of the sugar beet industry in the United States on the Pacific coast. The factory at Watsonville consumes seven tons of lime daily in the chemical processes of extracting the sugar, which is distributed *pro rata* to the grower of beets free, and can be returned to the soil. Besides, the farmers averaged over eighty dollars per acre for their beet products, while the recent report of the Agricultural Bureau estimates the returns from the total production of the five principal crops—oats, corn, rye, barley, and wheat—in the United States to be less than twelve dollars per acre on an average.

If the increasing production of Continental sugar continues in the same ratio as in the past, it needs no prophet to foretell the future of the sugar cane colonies. Even now the English market cannot afford to take colonial cane sugar, although it is admitted free of duty. The English refining factories, which represent an investment of fifteen to twenty millions of dollars, and have hitherto supported a large population of wage earners, are being closed, from the competition with Continental sugar.—*Popular Science Monthly.*

A California beet root sugar factory shows this result of a sixty-one days' run: Beets consumed, 14,077 tons; sugar produced, 1,640 tons; men employed, 135; average price paid for beets, $5.04 per ton; cost of manufacturing 1,640 tons of sugar, $148,247; sale of the product, $172,817; net profit, $24,570, or 5 per cent on the capital invested. The capacity of the factory has been increased, and the result of this year's run is watched for with interest. Last year the farmers in the Paiaro valley who raised beets for sugar purposes cleared from $40 to $65 per acre.—*Indianapolis News.*

CANE SUGAR.

As the results achieved by the Saint Cloud sugar factory at Kissimmee, Fla., this season, it is stated that the factory manufactured a crop of 1,500,000 pounds of sugar from 8,800 tons of cane—employing mills. This means a yield of over 170 pounds of dry sugar per ton—a result only exceeded by three of the thousand sugar factories of Louisiana in the last crop made. This is a pretty good showing for the commencement of the sugar industry in Florida. There is no telling what the extension of the Florida sugar interest may be now that dredging machinery is reclaiming the rich sugar lands of that State. In round numbers this country consumes annually 1,500,000 tons of sugar, with the probability of the consumption exceeding 2,000,000 tons before the close of the century.—*N. O. Times-Democrat.*

SORGHUM SUGAR.

It is evident from the report by the chemist of the Agricultural Department, Dr. Wiley, that highly satisfactory progress has been made in the solution of the sorghum problem, and in the entire range of American farming no other problem of equal difficulty has arisen. It is a combination of agriculture and manufactures in about equal parts, so far as concerns importance, but everything really hinges on the manufacturing process. It is easy to raise a crop. The entire corn belt can grow sorghum, although the saccharine qualities are not fully up to grade in all localities, but when it comes to reduce it to sugar, there the trouble begins. It cannot be done to advantage on a small scale, nor can the raw material be stored for any length of time or shipped to any considerable distance, herein bearing resemblance to cane raising, and not to grain raising. There must be a long season, say two months, for manufacturing, the water supply must be abundant, as also the coal supply. The cost of the plant is put down at from $60,000 to $100,000. It requires about as much expertness to run a sorghum factory as it does to run a starch mill.—*Chicago Inter-Ocean.*

CANE SUGAR COMPARED WITH SORGHUM.

It is interesting to compare the sorghum sugar industry of Kansas with the cane sugar industry of Louisiana. In the latter State good cane commands from $4 to $5 per ton, in the former $2. Sugar cane yields 200 pounds or so to the ton of cane, sorghum 80 or 90 pounds. In Louisiana the production is sometimes 25 tons per acre, and perhaps on an average from 15 to 20 tons; in Kansas, sorghum yields about 10 tons to the acre. So far, the advantage is all on the side of the sugar cane. On the other hand, that cane can be produced only in a comparatively small extent of country in one State, whereas sorghum can be grown in all the States south of the thirty-seventh parallel. Sugar cane takes rather more careful cultivation than sorghum, too. But the other is the decisive point. Louisiana cannot produce more than one-tenth or, at most, let us say one-eighth of the amount of sugar we need. The other seven-eighths must come from somewhere else. If it can be produced from sorghum, then there is a gain to the country.—*N. Y. Mail and Express.*

How to Change the Color of Canary Birds.

The following is from the proceedings of the Berlin Physiological Society:

Starting with the observed fact that canaries fed with Cayenne pepper acquire a ruddy plumage, Dr. Sauermann has based upon it a scientific investigation of canaries, fowls, pigeons, and other birds. From these he has obtained the following results. Feeding with pepper only produces an effect when given to young birds before they moult; the color of the feathers of older birds cannot be affected. Moisture facilitates the change of color to a ruddy hue, which is again discharged under the influence of sunlight and cold. A portion of the constituents of Cayenne pepper is quite inactive as, for instance piperin and several extractives; similarly the red coloring matter alone of the pepper has no effect on the color of the feathers. It is rather the triolein, which occurs in the pepper in large quantities, together with the characteristic pigment, which brings about the change of color by holding the red pigment of the pepper in solution. Glycerine may be used instead of triolein to bring about the same result. The same statement holds good with regard to the feeding of birds with aniline colors. The red pigment of the pepper is also stored in the egg yolk as well as in the feathers. The first appearance of the pigment in the yolk may be observed as a colored ring four days after the commencement of feeding with the pigment dissolved in fat; after a further two days' feeding the whole yolk is colored. Dr. Sauermann is still engaged in carrying on his researches.

The Meaning of the Word "Limited," as Applied to Corporations.

It has become somewhat common nowadays to see the word "limited," in parenthesis, after the titles of corporations, and it is safe to say that people generally do not understand the significance of this term, though, of course, business men do. An explanation of it, as stated in one of our exchanges, may, therefore, be of general interest. The old principal of corporations created by legislative act was that the entire property of every stockholder was liable for the whole of the company, as the whole property of every member of a general partnership is still liable for the debts of the firm. This system made every shareholder responsible for bad management, of which he might not be guilty, and deterred wealthy men from becoming interested in the shares of corporations. To remove this objection the principle of limited responsibility was introduced, and in order to notify the public that only the separate property of the corporation was liable for the debts of the corporation, the English law requires that the word "limited" shall be used in every case by the company in connection with its title. Most American corporations are constituted on the principle of limited liability, and but few, if any, of the States enjoin the companies formed under their laws to append the word "limited" to their corporate titles. The matter is so generally understood in this country by business men, however, that it is not deemed necessary, though many companies do it of their own accord.

The most noteworthy exception to the general rule is the case of the national bank, but even in this instance liability is limited to an amount equal to the par value of the shares held. That is, if the national bank fails, each stockholder may not only lose what he has invested, but $100 more for each share of the stock he holds, if so much is necessary to pay the debts of the bank. Until within a few years all the Scottish banks were organized with unlimited liability, and when, some eight or ten years ago, a Glasgow bank failed disastrously, there were cases of men who only owned a share or two, valued before the failure at not much more than $100, who were assessed thousands of pounds sterling to meet the debts of the bank. Since that time the Scottish banks have been allowed to reorganize on a limited liability basis.

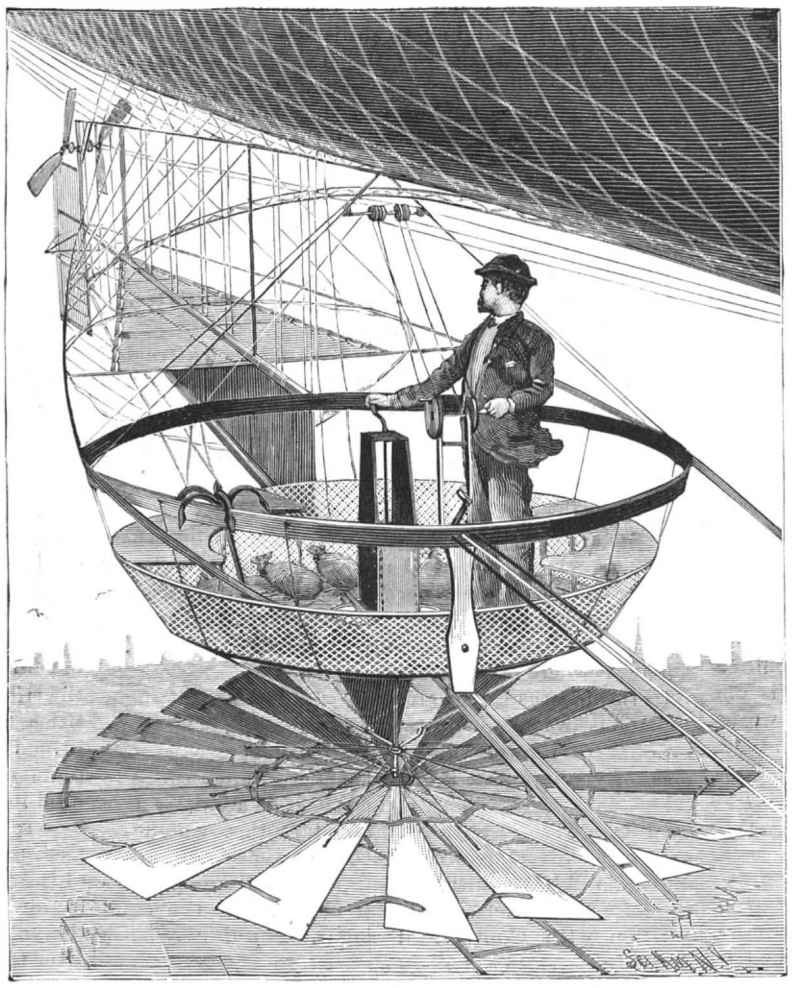
LOSS OF THE CAMPBELL AIR SHIP.

(*Continued from first page.*)

quarters of a mile the balloon broke away from the fastenings that were holding it down to the surface of the water and soared away to the southeast. The pilot boat found no trace of any car or any human being. There was also a report of an unknown balloon having been seen over Providence, R. I., on Tuesday evening, and a report that a balloon had been seen over Astoria, L. I., near where the air ship started, about midnight on Tuesday; but in neither case was there anything showing what had become of the aeronaut. Other indefinite reports mention a balloon having been seen at sea, but they are too vague to base any hope upon.

In the construction of this air ship the car is suspended from the balloon through an intermediate rigid bar extending over and from end to end of the car by means of suspending cords from the frame of the car to the bar, which are made fast also to the harness or netting of the balloon. The center of the car is circular in shape, and has a circular seat with arched guards reaching upward to the bar above. Extending fore and aft is a vertical keel, made of light framework, supporting a web of woven material. Nearly all of the framework of the car and its attachments was of wood and rattan, iron being very sparingly used, while the principal shafts and rods were hollow, and a thin fabric was used in the rudder and wings. The entire cost of the air ship is said to have been about $3,000.

Upon the two sides of the car are hinged wings so adjusted to the car as to allow a vertical movement at right angles, the position of these wings with regard to the horizontal plane being governed by guy or sheet ropes, one set of these ropes passing from the upper and the outer surface of the wings to the upper part of the arched guards and to the bar above, and the second set to the lower part of the car. Both fore and aft of the circular body of the car, and projecting laterally from the keel, are arranged triangular guide wings hinged to the keel, and normally standing out from it in a horizontal position, but capable of being swung downwardly with the upper part of the keel as an axis. At the forward end of the car and its keel is hinged a vertical rudder, after the manner of the rudder of a boat, but of a size to extend both above and below the body of the car. This rudder is controlled by a crosshead and tiller rope extending to the center of the car. At the rear end of the car, and with its axis in line with the axis of the car, is mounted a propelling wheel, the driving shaft of which is made to extend forward and into the center of the car, where it terminates in a crank by which the propelling wheel may be rotated. Beneath the car is a second propelling wheel, more especially designed to control the ascent and descent of the ship; it is mounted upon a vertical shaft extending upward through the bottom of the car, and also fitted with an operating crank.



CAR OF CAMPBELL'S AIR SHIP.

It was the intention of the inventor that the balloon should be of such size, as compared with the weight of the car and its propelling and steering apparatus, that its buoyancy, when filled with gas, would just counteract or balance the force of gravity on the complete device, so that only a small power would be necessary to overturn this balance, and raise or lower the machine in the air. Between the bar and balloon, and attached to both, is a web to assist in guiding the machine when moving in a horizontal direction, after the manner of the keel of a boat. Two oars are also provided to facilitate landing, and they are made in fan shape, with long handles, to work against the air when but little power is needed. To assist in turning the ship around quickly a propeller is worked from the fore part of the car, and one at each end of the rigid bar. Two anchors are provided, one for each end of the keel, from which they are suspended by cords running over pulleys to the center of the car, where they are attached to a small windlass. All of the machinery is worked from the center of the car.

In the trial of the Campbell balloon at Coney Island last summer, it was apparently very easy to control and direct its course as desired. The balloon first ascended about three hundred feet, then was brought down to be photographed, afterward ascending to about five hundred feet, where it was brought to a standstill, then it was started on a short excursion and again brought back to the starting place, sailing part of the time nearly straight against a light wind. After this the balloon was propelled around very nearly in a circle, and seemed to be completely under the control of the aeronaut, Mr. James Allen, of Providence.

The aeronaut, E. D. Hogan, was born in Canada in 1852, and at the age of 16 made his first balloon ascension at Jackson, Mich. It is said that he has made over 200 ascensions. Last year he was accustomed to ascend twice a week from Rockaway Beach to a height of some 5,000 feet, from whence he dropped to the ground by means of a parachute. Both the balloon and the parachute were made by himself, the balloon being inflated with hot air.

RECENT DISCOVERIES IN THE NEBULÆ BY MEANS OF PHOTOGRAPHY.

BY EDWARD S. HOLDEN, LL.D., DIRECTOR OF THE LICK OBSERVATORY.

It is not so long ago that it was pronounced to be "impossible" to photograph the nebulæ at all. The enormous improvement in the sensitiveness of photographic films within the past few years has permitted wonderful advances. Some of the results of such work are so recent that they are known only to the readers of scientific journals, and they are so important that I wish to exhibit them here to a wider circle.

The very first photograph of a nebula was taken in September, 1880, by the late Dr. Henry Draper, at his observatory at Hastings on the Hudson. In 1881 he obtained, with an exposure time of 104 minutes, a picture of the nebula of Orion which showed stars that were fainter than the faintest visible to the eye in his telescope (a refractor of 11 inches aperture, made by the Clarks, of Cambridge), and which displayed essentially all the details in the nebula which I had been able to make out with the much larger telescope at Washington (26 inches aperture). Moreover, my work at Washington required years, while his was done in one night. This photograph of Draper's led the way, and showed what might be expected from future work of the same sort. Draper's early death closed his series of studies in this path. His researches were taken up by Mr. Common, of London, who built a 3 foot reflector for the purpose, and who succeeded (in 1882) in making a magnificent picture of the *Orion* nebula.

Mr. Roberts, of Liverpool, using a reflector of 20 inches aperture (and of short focus), has made a series of pictures of this nebula also, which serves to show the law according to which it is built up. His series begins with a negative exposed for five seconds only. This exhibits the central bright stars of the nebula and a small portion of the brightest nebulosity. Successive pictures with exposures of 30, 60, 180, 360 seconds show more and more of the nebula itself, and the last one gives all of the object which can be seen in a powerful telescope.

Not only is everything visible, but it is permanently registered, and the six minutes of exposure have sufficed to make a map for which a year's work might be necessary if done with the eye alone.

Other photographs of 15, 30, 81, 210 minutes show more and more of the nebula and extend its limits over vast spaces.

The various photographs of the series, taken together, establish the order of brightness of the different parts of the nebula and give a set of lines of equal light by means of which its structure becomes more intelligible.

It is of Mr. Roberts' recent wonderful photographs of the nebula in *Andromeda* that I wish more particularly to speak. This great nebula is just visible to the naked eye and is mentioned in Sufi's Uranometry (about 900 A. D.) and is a well known object to possessors of small telescopes. Little was added to our knowledge of the nebula until Professor Bond at Harvard College observatory made a careful study of it in 1848. The nebula was shown to have an immense extent, and the most curious feature exhibited was the presence of two long straight vacant spaces or canals extending through most of the central portions. The work of Professor Bond was repeated with the same telescope about 1874 by M. Trouvelot, and his elaborate drawing is reproduced in our Fig. 1.

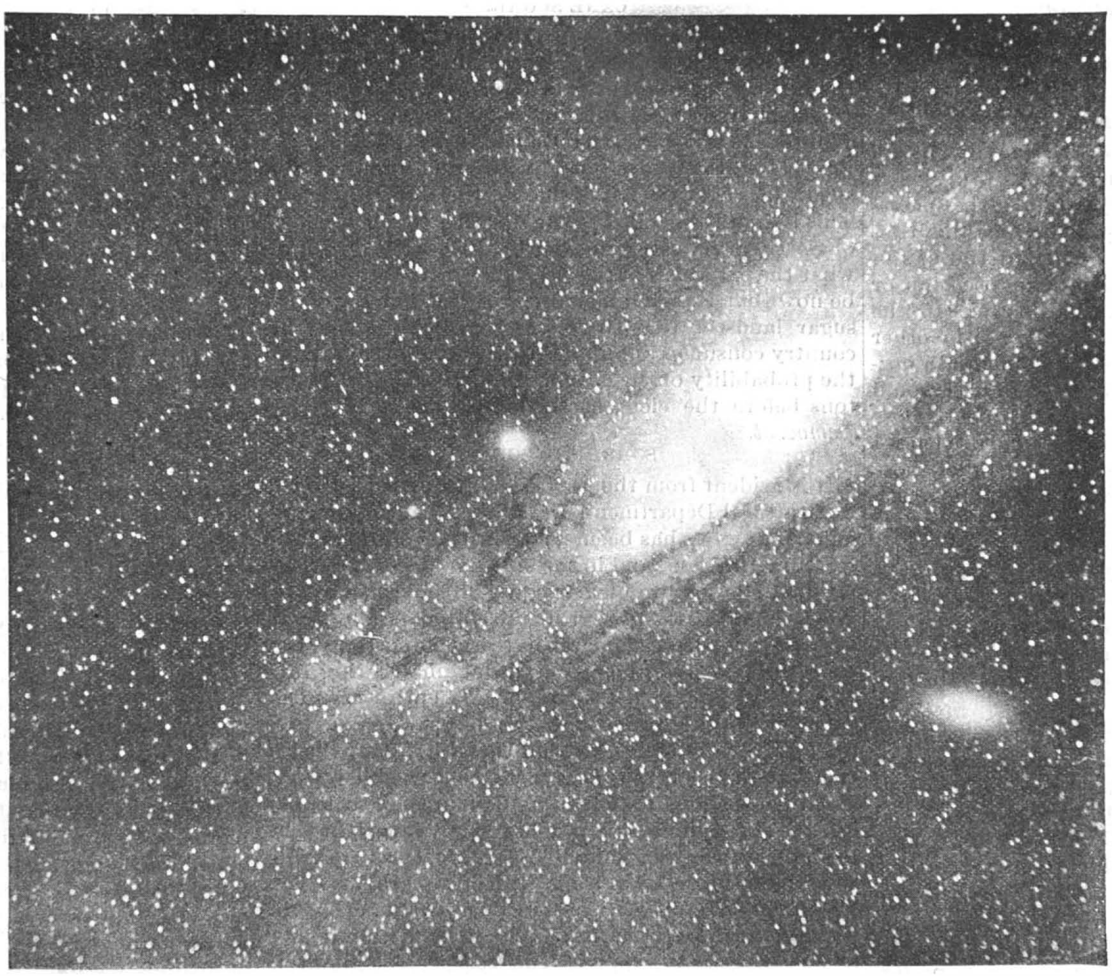


Fig. 1.—THE ANDROMEDA NEBULA. DRAWN BY L. TROUVELOT (1874).

Little can be added by the eye to this splendid picture. Small details can be corrected, but it must be accepted as a substantially correct representation of what the eye sees with even a very large telescope.

Fig. 2 represents a part of the same object as photographed by Mr. Roberts with an exposure of two hours. And here for the first time we obtain some adequate conception of the true forms of this great nebula.

Instead of the two straight rifts of Bond, sharply terminated at both ends, we find two huge vacant *rings* of blackness, surrounding the central portions. Other rifts and vacancies exist in the photograph, which are quite invisible to the eye; and the whole nebula is exhibited in a new light.

It is seen to consist of a system analogous to that of the planet *Saturn*—a central mass surrounded by rings, which are separated from the central body by empty spaces. Like the rings of *Saturn*, the rings of the *Andromeda* nebula are probably composed of myriads of small discrete solid particles revolving in swarms about their primary. The vacant spaces in *Saturn's* ring are caused by the attractions of the larger satellites of that planet on the smaller particles of the ring. No doubt the vacant spaces in the nebula are caused in the same way.

It is possible that the two brighter masses lying beyond the central bright body of the nebula are in fact the effective causes of the vacant spaces. But we can safely go a step further in our search for analogies. Laplace considers *Saturn* as a striking proof of the Nebular Hypothesis which he proposed. The planet represented the final stage of the very process by which the solar system might have been condensed out of the primal nebula. In the Andromeda nebula do we not actually see before us a still earlier stage of the same process, where worlds are forming though not yet formed? Are not a planet like *Saturn*, the Andromeda nebula, and one of the inchoate gaseous nebulæ three successive steps in the evolution of the universe?

The interval of time required for the progress from one of these stages to the next is so immense that the whole of human history is a mere instant in comparison. But have we not a different means of tracing these steps? As Sir William Herschel nobly said in 1789: "The maturity of a sidereal system may thus be judged from the disposition of its component parts. . . . This method of viewing the heavens seems to throw them into a new kind of light, and one advantage that we may at least reap from it is that we can, as it were, extend the range of our experience to an immense duration. For is it not the same thing whether we live successively to witness the germination, blooming, foliage, fecundity, fading, withering, and corruption of a plant, or whether a vast number of specimens, selected from every stage through which the plant passes in the course of its existence, be brought at once to our view?"

From this point of view we may regard Mr. Roberts' discoveries in the Andromeda nebula as the most important which have been made since the time of the Herschels. His photograph really represents a stage in evolutionary history which has been prefigured by the eye of reason, but which is new to the eye of sense. We cannot doubt that the methods which he has employed are to yield more evidences of the same nature. And it is sure that his methods are to be faithfully followed up.

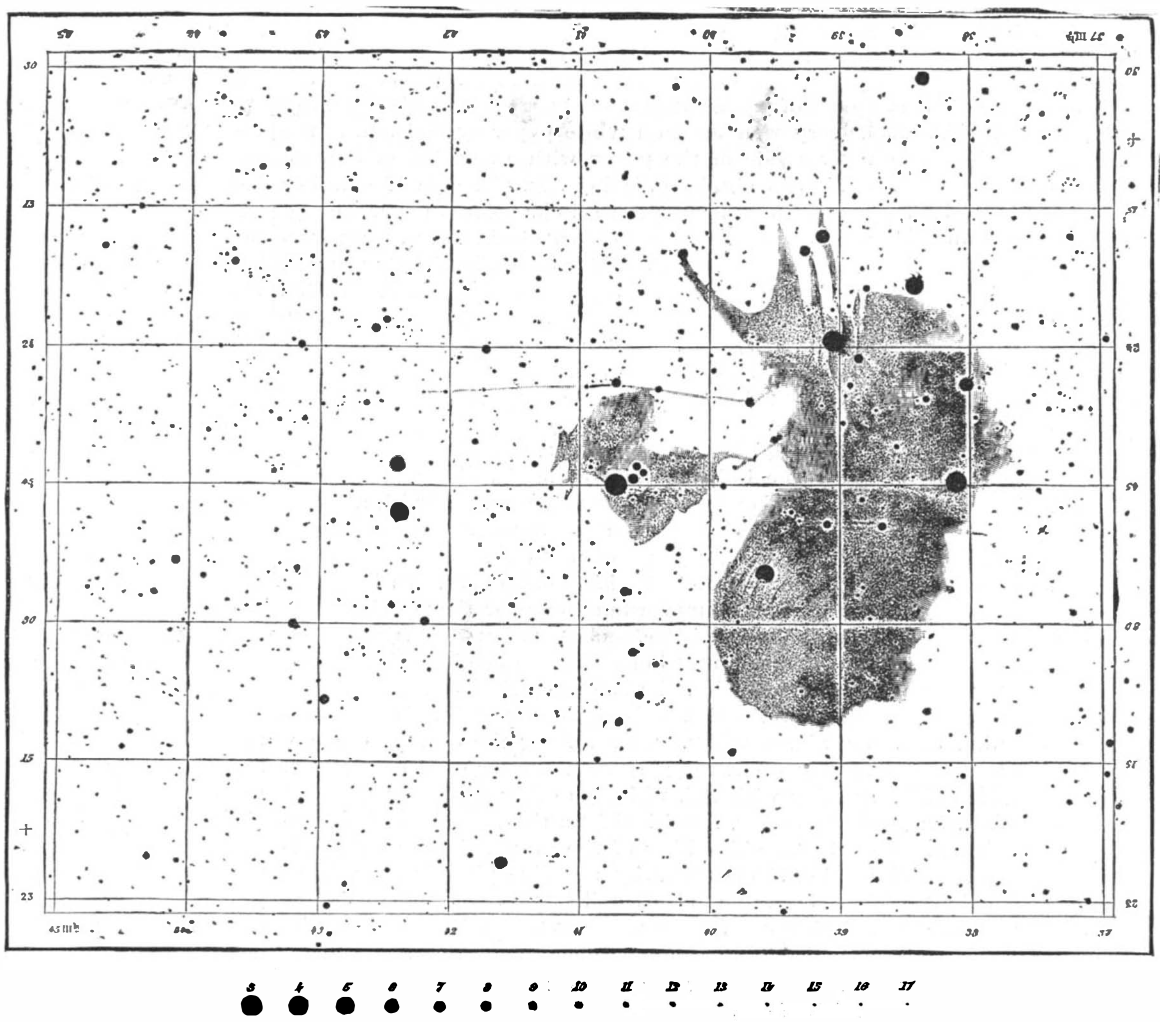


Fig. 3.—CHART OF 2326 STARS IN THE PLEIADES. PHOTOGRAPHED BY PAUL & PROSPER HENRY (1888).

The brightest star is 3d, the faintest is 17th magnitude.

The brothers Paul and Prosper Henry, of the Paris observatory, have devoted the past few years to perfecting their apparatus for astronomical photography as applied to the making of star charts. In the course of their work they have discovered an entirely new nebulous region connected with the principal stars of the Pleiades group. Formerly only one nebula was known in this group, attached to the bright star *Maia*.

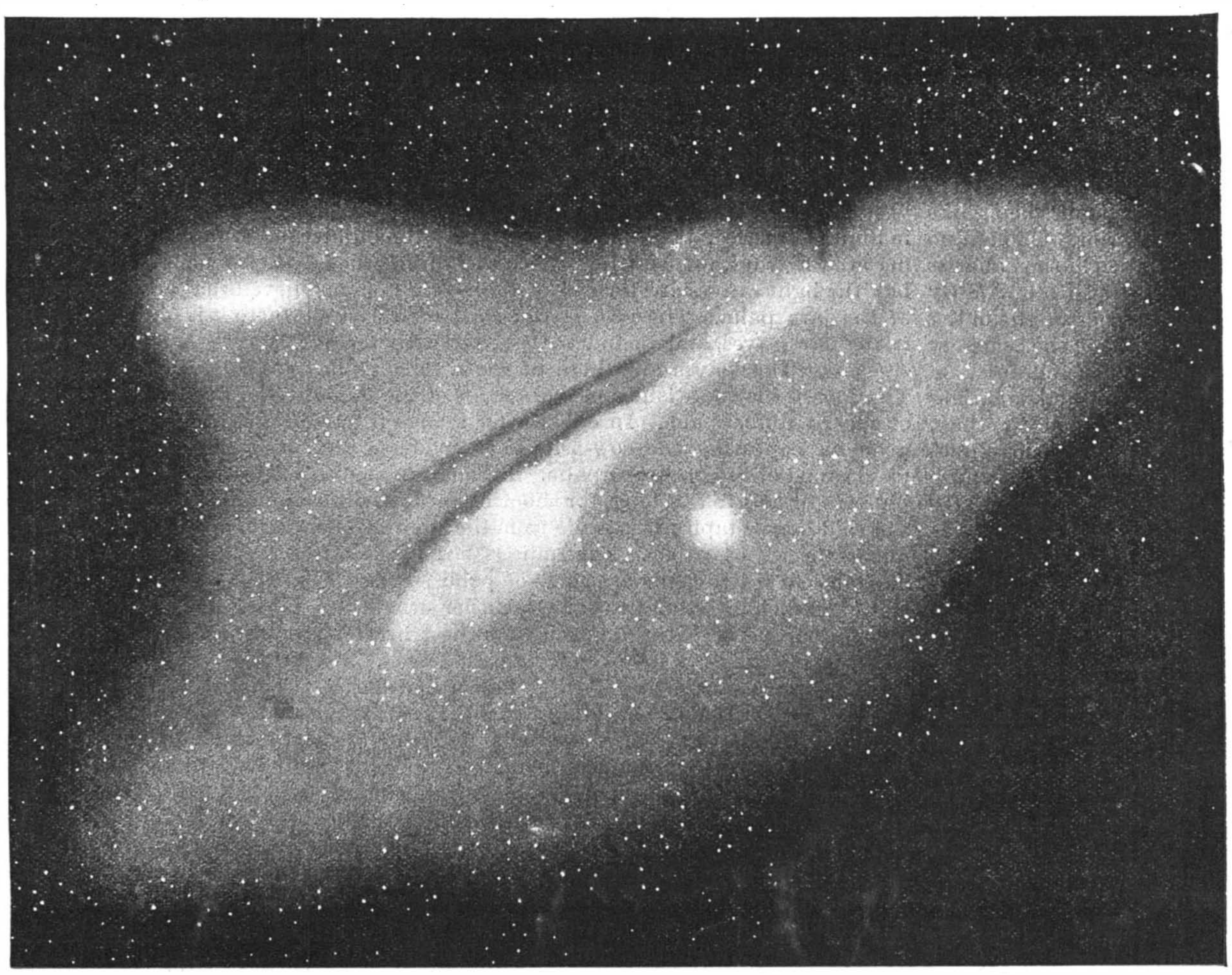


Fig. 2.—THE ANDROMEDA NEBULA. PHOTOGRAPHED BY I. ROBERTS (1888).

None of the stars of this figure are visible to the naked eye.

The photographs of Paris have shown the whole group to be connected with a complex nebula. One of the most curious and interesting of the revelations of these photographs is well shown in Fig. 3.

From the upper part of the right nebulosity, a slender thread of light is seen to extend toward the west, passing through at least eight of the stars of the cluster. (The reader should find this on the map between the lines 40 and 42 from the bottom and 24 and 45 from the side). It is certain that these stars are connected with the nebula, and that the nebula is connected with the seven bright stars of the Pleiades group, and must therefore be at the same distance.

As might naturally be expected, photography is a powerful aid in the discovery of new nebulæ. Professor Pickering, at the Harvard College observatory, has explored a small region of the sky in this way, and his photographs show thirty nebulæ in a region where but eighteen were previously known.

The new nebulæ were faint and small, naturally, but the experiment shows what can be done in the way of mere discovery.

The need of astronomy is, however, not so much the discovery of new objects as more information about well-known ones.

Dr. Gothard, of Hungary, has lately shown that even a comparatively small telescope is adequate to give this. With his 10 inch reflector he has photographed many nebulæ (on a small scale necessarily), and on examining the negatives, Professor Vogel has found that even these small pictures are superior to the best drawings of the same objects with the largest telescope. There are many similar researches marked out and waiting for experiments, and the success of Dr. Gothard has proved that giant telescopes are not essential.

The refractor of the Lick observatory has some advantages in researches of this nature on account of its great focal length (47 feet), which gives a large size to the picture. The experiments which we have so far made promise excellent results in photographing the nebulæ. An exposure of ten minutes on some of them is ample. When the great telescope is completely fitted for photographic work (which will be shortly), it is to be assiduously used in this field.

I have gone rapidly over the advances which have been made in the photography of the nebulæ in the nine years since the first nebula photograph was taken. The wonderful pictures of Draper, Common, Roberts, and others will have a permanent value, as they serve as means for comparison with later work and as it is only by such comparisons that evidences of change can be detected. Photographs of the nebulæ have a great advantage over mere drawings, no matter how carefully made, for such a purpose, as they are devoid of personality and record *exactly* what they see. Moreover, they command a large field of view, while the ordinary eyepiece is far too small to deal with large objects.

By exposing the negative to the light of a standard lamp (as is done at Harvard College and at the Lick observatory), we may impress on the plate a series of standard squares of known brightness. Comparing

these with the nebula, we may gain a numerical estimate of the brilliancy of each portion of each nebula examined. Such data are priceless for the purpose of detecting future changes in the nebulæ.

The revelations of the *Andromeda* nebula photographs are distinctly new, and throw a flood of light upon the secret processes of creation itself. Not a hundredth part of the brighter nebulæ have yet been photographed, and it is certain that discoveries no less important than those of Mr. Roberts are near at hand. One great advantage of the new method of research is its absolutely autographic character; and an incidental excellence is that its results are so easily exhibited to others than the observer. The pictures in this article, for example, place the whole data before the reader as fully as they are laid open to the astronomer himself. They simply require intelligent interpretation.

Natural History Notes.

The Great Dragon Tree of Orotava.—With an antiquity rivaling, probably exceeding, that of the pyramids of Egypt, and a reputation scarcely inferior, it is remarkable, says an English paper, how little notice has been taken of the death of the colossal dragon tree of Orotava, which has been visited by nearly all the travelers, historians, monks, peddlers, and soldiers who have had the mildest globe-trotting propensity. Though called a tree in popular language, the renowned curiosity of Orotava was nothing of the sort, but was a kind of gigantic asparagus related to the delicate lilies of our gardens. The natives venerated this old monster. They regarded it as possessed of animal life, and deified it, and in its hollow trunk performed druidical rites. They used its blood-red sap (the dragon's blood of commerce) for embalming their dead.

When Alonzo de Lugo, the conqueror of Teneriffe, came to Orotava in 1493, he spared the tree, but, scandalized at the profane mysteries which had taken place in its interior, he converted its hollowness into a chapel for holy mass. Humboldt, in 1799, gives its height as "appearing" about 50 or 60 feet, and its circumference near the roots as 45 feet, and the diameter of the trunk at ten feet from the ground "is still 12 English feet," and he computed its age at 10,000 years. The opening was so large that a table was placed in it, round which fourteen persons could seat themselves; and a staircase in the interior conducted the visitor up to the height whence the branches sprang.

Slow indeed must have been its growth, for 400 years after the visit of the first navigators Le Dru measured the tree most carefully, proving that during that long period the increase had only been one foot at the base, the other dimensions being practically identical.

In botanical language the dragon tree is *Dracæna draco*, and is described as having a tree-like stem, which, when the tree is very old, becomes much branched, each branch being terminated by "a crowded head of lanceolate linear entire leaves of a glaucous green color, which leaves embrace the stem by their base, and on falling off at maturity, leave a ring-like cicatrix or scar." In old age curious warts appear, and one from the old Orotava tree has been preserved, which is as large as a good sized cocoanut, being like that fruit in shape and its rough exterior. Though no particular care has hitherto been taken in the Canaries to rear these curious trees, there are still a few fairly sized specimens for the visitor to see, one of the oldest extant being probably that at the gates of the cemetery at Icod. It is mentioned in the ancient chronicle of the conquest of the island of Teneriffe, and standing in solitary grandeur is the best specimen to study. There is one other good example at Icod de los Vinos, which may be even older. These dragon trees, however, are small and absurdly young when compared with the old veteran which till recently guarded the golden apples in the Garden of the Hesperides.

Bleaching the Wings of Lepidoptera.—By the Dimmock process, the wings are first acted upon by a saturated solution of the chloride of lime, chlorine being, of course, the bleaching agent. Afterward they are washed in water to which hydrochloric acid has been added to get rid of the slightest deposit of lime. The process is a slow one for thickly sealed, dark-colored insects, and it occurred to me to try a mixture of the chloride and acid, liberating the chlorine gas. The method was absolutely successful, the wings decolorizing immediately and being ready for the slide within two minutes. In fact, very delicate wings can scarcely be taken out quick enough, and need very little acid. The advantage is the rapidity of work and the certainty of retaining the wings entire, the chloride of lime sometimes destroying the membrane in part before the bleaching is complete. The disadvantage is the vile smell of the chlorine gas when liberated by the combination of the two liquids. For quick work this must be endured, and the beauty and completeness of the result are also advantages to counterbalance the discomfort to the senses.—*J. B. S., in Insect Life.*

The Place of Sigillarias in the Natural System.—There has been a great divergence of views among naturalists as to the place that sigillarias should occupy in the natural system. Mr. Grand-Emry, after some new researches on those plants, has come to the conclusion: (1) that the sigillarias, despite the radiated structure of their wood, which constitutes a character of but the second rank, must be classed among the vascular cryptogams; (2) that, although cryptogams, they are connected with no living type, and form a family of plants that wholly disappeared at the close of the paleozoic period.

Fixing the Spores of Hymenomycetes.—Dr. C. O. Harz proposes the following plan for preserving the spores of hymenomycetous fungi. Colored spores can be very well fixed on white paper by moistening the reverse side of the paper with a solution of Canada balsam in absolute alcohol. In the case of colorless spores, the difficulty is to find a colored paper the pigment of which is not soluble in alcohol. Dr. Harz overcomes this difficulty by using instead a slightly warmed solution of 1 vol. Canada balsam in 4 vols. turpentine oil, placed with a fine camel's hair brush on the reverse side of the paper. In the course of from two to four days the preparation can then be laid aside between paper, but the spores are not completely fixed for several weeks.

Effect of Electricity on Germination.—In order to study the influence of voltaic electricity, Mr. H. N. Warren placed pads of cotton, saturated with a dilute solution of salt and sown over the surface with common mustard seed, upon the platinum plates connected with four constant ferric chloride cells. In less than twenty-four hours germination over the positive plate was distinctly visible, and at the end of a week the growth was upward of an inch in height and of an intense green color. In the same time on the negative plate germination had only commenced and the growth was almost white. On reversing the current the previously flourishing growth became bleached and speedily withered, while the other gradually assumed a green color, flourished for a time, and then also withered. The bleaching of the growth in the neighborhood of the temporarily negative plate is thought to have been due to the small but constant liberation of chlorine, and it seems evident that this factor must be excluded from the experiment before correct conclusions can be drawn as to the relative influence of the positive and the negative current on germination.

Peculiarities of Vision in Insects.—A correspondent of *Le Naturaliste*, referring to the curious fact that neither flies nor wasps will venture to pass through a window across which a piece of fish net is stretched, asserts that the phenomenon is due to the confused vision possessed by insects. The threads of the net give them the impression of a continuous surface, just as with us do the hatchings of an engraving that we look at from a distance. The animal believes itself to be in front of a more or less translucent obstacle, but one in which it distinguishes no orifices.

Uses of Palms.—In order to be able to appreciate how much the native tribes of the countries where palms most abound are dependent upon this noble family of plants, and how they take part in some form or other in every action of the native's life, we must enter his hut and inquire into the origin and structure of the various articles we see around us. Suppose we visit an Indian cottage on the banks of the Rio Negro, in South America. The main supports of the building are the trunks of some forest tree of durable wood, but the light rafters are formed of the straight stems of the jara palm. The roof is thatched with large, triangular leaves, and bound to the roof with forest creepers. The leaves are those of the carana palm. The door of the house is a framework made of the stems of the pashinba palm. In one corner stands a harpoon for capturing the cow-fish; it is made of the black wood of the pashinba palm. Beside it is a blow pipe ten or twelve feet long, for shooting birds or even the wild hog or tapir; it is made from the stem of one of two species of palms. The Indians' large bassoon-like musical instruments are made of palm stems; the cloth in which he wraps his valued feather ornaments is a fibrous palm spathe, and the rude chest in which he keeps his treasures is woven from palm leaves. His hammock, bow-string, and fishing line are from the fibers of leaves which he obtains from different palm trees, the hammock from the miviti, and the bow-string and fishing line from the tucum.

The comb that he wears on his head is ingeniously constructed from the hard bark of a palm, and he makes fish hooks of the spines, or uses them for tattooing purposes. His children are eating the agreeable red and yellow fruit of the pupunba or peach palm; and from the assai he has prepared a favorite drink which he offers you to taste. That carefully suspended gourd contains oil which he has extracted from another species of palm; and that long elastic plaited cylinder used for squeezing dry the mandrocea pulp to make his bread is made of the bark of one of the singular climbing palms, which alone can resist for a considerable time the action of the poisonous juice. In fact, there seems no end to the economical purposes to which the products of palms are applied in the countries where they grow.

PAINT made with turpentine is a better protector for iron work than it is when mixed with flaxseed oil.

Mineralogical Notes.

BY GEORGE F. KUNZ.

Fluorite.—About four years ago, a small vein of fluorite in Archæan limestone was discovered in the town of Macomb, St. Lawrence Co., New York. It was worked from time to time until last summer, when the vein suddenly widened, breaking through into a cavity or cave. This cave is 22 ft. north and south, 18 ft. east and west, and 8 ft. below the surface. It dips from the south to the north, and is about 8 ft. lower than at the mouth or entrance. It is about 5 ft. between the walls. A pool of water in the northeast corner, about two feet in depth, often rises ten or twelve inches during the day. The top, bottom, and sides were lined with a magnificent sheet of crystals, varying from one to six inches in diameter, each in turn forming part of larger composite crystals. Between the floor and the walls was a layer of partly decomposed calcite, which was readily removed, so that groups of crystals, weighing from ten to several hundred pounds each, and one of them measuring 2 × 3 ft., were easily detached.

The cavity contained at least fifteen tons of fluorite. The habit of the crystals is in nearly every instance that of the simple cube, but the faces of the octahedron, slightly developed, are often present. Almost all the crystals have on the surface, in small botryoidal elevations, an even coating of brown hydrodolomite, which is readily removed with diluted hydrochloric acid. The crystals are all well colored, but the surfaces are dull. The fluorite is of a uniform light sea green, except where it is attached to the gangue, or at the junction of the crystals; here there are small spots, from one to two inches in diameter, of a rich emerald green. Attached to the fluorite are small masses of lithomarge, and imbedded in these, very perfect tetrahedral crystals of chalcopyrite. With the fluorite are found small bunches of pyrite crystals, which are nearly always altered to limonite. Galenite has not been observed, although this locality is only one and a half miles from the well known Macomb lead mines. Several years ago, a large quantity of rhombohedral crystals of calcite were obtained here; one now in the State cabinet of Albany weighs 120 pounds, and a number were of the size of a man's head. In form they were simple rhombohedrons, and twinned. This find is strikingly like that of the famous Muscalonge Lake localities of forty years ago, except that the crystals are of a finer color and in larger groups. The occurrence of a second deposit in this country leads to the inference that fluorite may exist in commercial quantity, for the arts.

Amber.—For the last fifteen or twenty years, travelers have occasionally brought specimens of a very remarkable amber from some locality in southern Mexico. The only information gained concerning it is that it is brought to the coast by natives, who say that it occurs in the interior so plentifully that it is used by them for making fires. The color of this amber is a rich golden yellow, and when viewed in different positions it exhibits a remarkable fluorescence, similar to that of *uranine*, which it also resembles in color. A specimen now in the possession of M. T. Lynde measures 4 × 3 × 2 inches, is perfectly transparent, and is even more beautiful than the famous so-called opalescent or green amber found in Catania, Sicily. This material would be extremely valuable for use in the arts. It is believed that an expedition has started for the locality where it is found in the interior.

Opal.—A specimen of fire opal 1½ × 1 ×½ inches in size, evidently a water-worn fragment, was found near John Davis River, in Crook County, Oregon. It is transparent, grayish white in color, with red, green, and yellow flames. The play of colors equals in beauty that of any Mexican material, and it is the first opal found in the United States that exhibits color. Undoubtedly, better material of the kind exists where this was found.

Diamond.—During the summer of 1888 a small diamond was said to have been found by Mr. C. O. Helm on the farm of Henry Burris, about three hundred yards from Cabin Fork Creek, Russell County, near Adair County, Kentucky. While walking through an old field, on the top of a hill, Mr. Helm observed in the gravel this small, bright stone, which on investigation proved to be a diamond, an elongated hexoctahedron, with curved faces, lustrous, but slightly off color, weighing $\frac{7}{16}$ carat. The rock in the vicinity is said to be composed of granite dikes, slates, and some floating rocks, such as quartz, feldspar, magnetic iron ore, flint, garnet, etc., mingled in clayey hills.—*American Jour.*

THE problem of reducing aluminum on a commercial scale by electrolysis has given rise to numerous experiments, and the *Bulletin Internationale de Electricite*, in a recent number, describes a new process due to M. Hoampe, the principle of which is as follows: When a mixture of cryolite and common salt is electrolyzed at a temperature below 1,000 deg., aluminum chloride is not formed, as the common salt is decomposed. At a higher temperature, however, the sodium chloride is reduced and aluminum deposited on one of the electrodes.

[SPECIAL CORRESPONDENCE OF THE SCIENTIFIC AMERICAN.]

THE PARIS EXHIBITION.

THE LOCOMOTIVE EXHIBITS.

PARIS, June 27.

There are more locomotives exhibited at this exhibition than there have been at any previous one, and I believe that the same may be said as to the diversity of designs. The English seem to have settled down to a fairly settled practice in the designs of many details of locomotive construction, which the French, Belgians, and Italians seem to be all at sea upon. The Stephenson link is almost universal in English and American practice, while in the exhibits here the Crampton and Walshaert valve motions hold the field, the valve gear sometimes sticking out nearly two feet from the wheels, the crank pin receiving the piston thrust and driving the coupling rods and valve gear. Again, the box form of Stephenson is rarely seen in American or English practice, as it is an expensive form to work, while the amount of wearing surface on the dies is limited. It is certainly an expensive form to repair, but it displaces the solid link in French and Belgian practice.

Neglecting for the present the compound engines and referring to the ordinary engines, we may begin with the Yapeyu, an engine evidently designed for the colonial trade and to meet a competition in prices, since the more costly forms of design are avoided. She is an outside cylinder four-wheel coupled engine having a cow-catcher and buffers, the latter evidencing that she is not intended to go around such sharp curves as are often found on railroads in countries where cowcatchers are necessary. She has a single guide bar, the connecting rod being solid both ends with no means of taking up the wear of the crosshead end of the rod. She has the old style of English coupling rods, the keys of both rods being recessed for the points of the set screws (a practice that might be more honored in the United States than it is at present). The boiler feed is supplied by a single plunger pump driven by an eccentric, and is supplied with pop valves. There are two gauge glasses, one on each side of the fire, but no gauge cocks.

The best exhibit is one of the Midland R.R. Co. of England. It has an American truck or bogie as it is called here, and a pair of 7 ft. 6 in. driving wheels, the cylinder being 18 in. diameter and the stroke 26 in. The details of this engine are of the usual English type but attention may be called to one or two points that differ from American practice. The English still cling to the old siphon feed oil cups, and in the case of connecting and coupling rods (and if I am not mistaken sometimes in the case of guide bars also) forge them solid on the straps. An example of one of the oil cups on this engine is given in Fig. 1 herewith, A being a piece

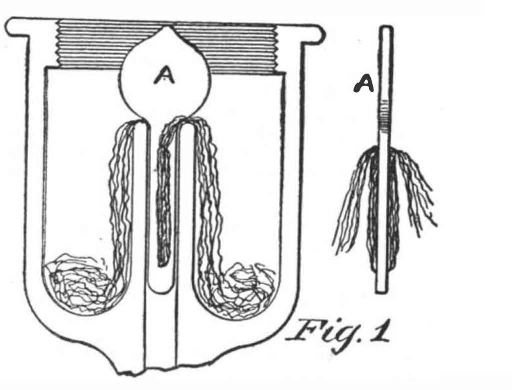


Fig. 1

of brass with holes in it through which six strands of worsted are threaded.

Of course such siphons feed the oil continuously whether the engine is running or not, but this has no importance in English practice. Another example of the oiling details is shown in Fig. 2, the gland having

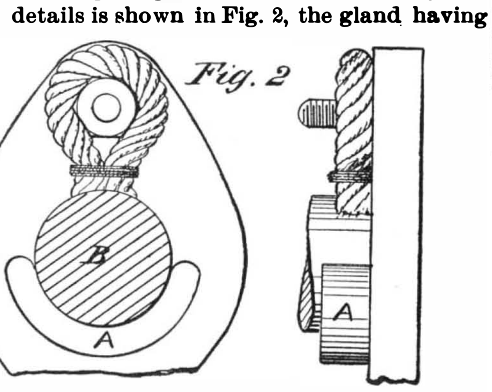


Fig. 2

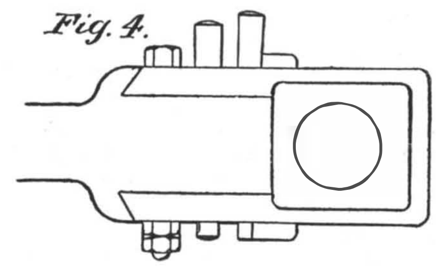
a recess, A (beneath the slide spindle, B), which is stuffed with worsted saturated with oil. At C is a loop of worsted tied around the nut, and receiving oil which feeds down to the spindle. The cylinders are oiled by a feeder outside the smoke box, which takes steam from the steam pipe and feeds oil into it, the feed occurring from the condensation of the steam, the accumulating water causing the oil to overflow through a pipe. The reversing gear is operated by a hand screw.

The air brakes are used in three ways, that is to say, three handles; one puts the brake full on the engine, tender and carriages, another does the same, but more moderately, as it acts slower (its air pipe being of smaller diameter), the third puts the brake on the engine and tender only. The boiler feed is two vertical injectors in the cab.

The starting handle has a clip grip on the square of the rod, as shown in Fig. 3.

Fig. 3.

Fig. 4.



The connecting rod of this engine is not of the ordinary English type, but of a class that is very old, and if I remember rightly was designed by Crampton, the bolt (see Fig. 4) being an addition. It is an expensive piece to make, and not so good in my judgment as the ordinary English form.

The Southeastern Railway Co. exhibit engine No. 240, which is a good example of English practice, simple, mechanical-looking, and well built. It is a four-wheeled coupled engine with truck (bogie).

The principal dimensions are as follows:

Diameter of cylinder	19 inches.
Stroke of piston	26 "
Pressure of steam	150 lb. per sq. inch.
Grate area	1,678 sq. ft.
Heating surface of boiler	1,085 " "
202 tubes, outside diameter	1⅝ inches.
Driving wheels	7 feet diameter.
Weight on truck	13 tons.
" " driving weeels	15 tons 8 cwt.
" " trailing wheels	12 tons 17 cwt.
Weight of tender when loaded	30 tons.
Coal capacity of tender	3½ tons.
Water " " "	2,650 gallons.
Diameter of boiler	4 ft. 4 in.

The transverse seams of the boiler (which has no dome) are single riveted, and the longitudinal ones double riveted with lap joints. The cylinder parts are 16 inches long and 1½ inches wide. The valve lap is 1 inch, and the valve travel $4\frac{5}{16}$, the cylinder exhaust port being 3½ inches.

The reversing gear is worked by a steam and an oil cylinder standing vertically on the foot plate directly over the reversing shaft. The slide valves are oiled intermittently from a steam oiling device in the cab. There are two injectors for the boiler feed, and a steam feed to the sand pipe, the steam jet coming into the pipe close to the wheel (a plan now being generally followed in Europe). Among the many interesting details pointed out to me by the assiduous attendant of this engine is one that might more often be copied than it is, viz., there are three washers on the bolts at the foot of the eccentric rods, which gives good facility (by reducing the washers) for lining the rods to length. The workmanship of this engine is very good and the proportions mechanical-looking and substantial.

We may next take a Belgian engine, and the Belgians have a large and fine exhibit here. The engine claiming first notice is labeled Grand Central Belge Ateliers de Louvain. It has outside cylinders 24x26 inches, eight wheels coupled, and Walschaert valve gear. The workmanship of this engine is very fine, and the proportions substantial and good, but driving the valve gear as well as the wheels from the crank pin would be considered decidedly objectionable either in American or English practice, especially as parts of the gear stand at least eighteen inches out from the wheel hub. The coupling rods have some details not usually found. Thus Fig. 5 shows one end of the coupling rod, the

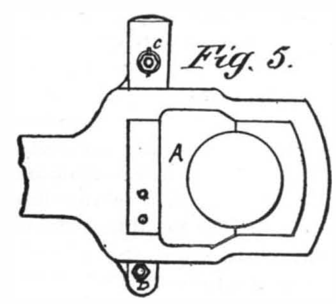


Fig. 5.

brass A being wider than its mate to let the crank pin flange pass through when taking the rod off or putting it on. The bolts C and D pass through the key and into a lug solid on the rod and having a slot in to let the bolts pass down with the key. Fig. 6 shows the connection between the two coupling rods, the piece, A, forming a joint for horizontal motion, and joint B one for vertical motion. This allows the rods to swivel when the engine is going round a curve. The bolt, C, passes through A and D, the latter forming an abutting piece for the brass, E. At F is a plate or block, preventing the key from imbedding in the brass, G.

The oil cup of this engine is of a peculiar construction, which is being brought into use here for greasing rather than oiling bearings. The cup is filled with a soft grease, which is forced on the bearing by screwing down the cap of the cup. Fig. 7 shows the construction. The outside, A, of the cup is threaded to receive the cap, which has on it a lever, C, threaded at p; f is a leather held to B by screw, g. The cup being filled with grease, the cap is screwed on till it forces the

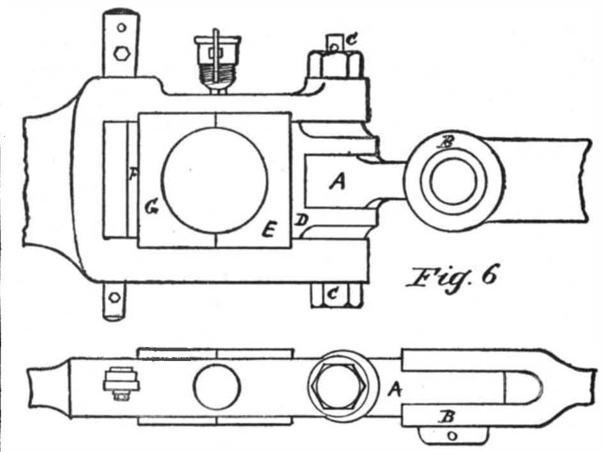


Fig. 6

grease down on to the journal; to feed the grease, the cap is turned to screw down. At h is a groove with a straight side on the right hand, and running gradually out on the left hand, so that the end, p, of C will slide over the groove to let the cap screw down, but will abut against the straight side of groove, h, and not let the cap unscrew. At e is a spring to keep p on the thread on the outside of the cup. Other details of

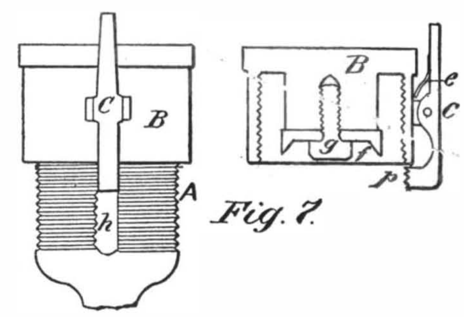


Fig. 7.

this engine are that it has a steam sand feed; the smoke box door folds in two like a French window. There are two spring balances on the dome (not pop valves). The stuffing box bolts on to the cylinder cover. The steam pipes pass outside the boiler to the cylinders. The boiler, the steam pipes, and the cylinders are lagged with polished sheet brass.

JOSHUA ROSE.

Answer to G. W. R.—"The Recurved Double-Fanged Climbing Rattlesnake."

G. W. R., of Andrews, Ind., sends a description of a snake he has lately captured, and desires us to give its scientific name. We cannot identify it by his description. He should have given the character and number of the head plates, the number of abdominal and subcaudal plates, and the character of the dorsal scales. It may be a variety of the *Coluber obsoletus* of Say. The black snake and "blue racer" are merely color varieties of the same serpent, viz., *Bascanium constrictor*. They are no more of a different *species* than a black and a gray horse.

Dr. F. W. Coleman, of Rodney, Miss., informs us that we omitted from our list of poisonous serpents (SCI. AMER., May 11) the "*recurved double-fanged climbing rattlesnake*." All rattlesnakes have recurved fangs; their acute tips invariably turning more or less forward. Individuals of many species have been found with double fangs, from the large swamp rattler to the little "ground rattlesnake." I have noticed double fangs in *Crotalus horridus*, the banded rattlesnake, and have known them to have been taken with three fangs on one side and two on the other; and I have observed double fangs in a large specimen of *Trigonocephalus* from Central America. Dr. Fayrer says the cobra of India often has double and sometimes triple fangs. In all of these instances the anterior fang on each side is the *fang proper*, the others or posterior ones are simply reserve fangs, ready to take the place of the fangs proper, when broken and lost, as they frequently are.

No particular rattlesnake can be considered a distinct species simply because it sometimes climbs upon bushes, stunted trees, and fences in search of prey, as this habit has been observed in very different species.

C. FEW SEISS.

How to Kill Trees.

Old Reader's inquiry has elicited several responses. One correspondent recommends muriatic acid, saying that it was used by a telegraph company to kill trees that were in the way of their lines. Another reader recommends boring a hole at the base of the tree and filling with crude kerosene. Some leaves must be tacked over the hole to keep out the rain. This he asserts will kill tree and roots so that there will be no sprouting. Another replies to Old Reader thus: "Bore small holes and apply a few drops pure carbolic acid." Old Reader therefore can take his choice.

RECENTLY PATENTED INVENTIONS.

Engineering.

SPARK CONDUCTOR.—Edward J. Brandt, Watertown, Wis. This is a device for discharging the smoke of the locomotive at the rear of the train, pipes leading from the opposite sides of the smoke box to longitudinal channels formed on the cars, there being a removable pipe between the locomotive pipes and the car channels, with the necessary couplings, and a fan or blower in one of the cars connected with the pipes.

CUT-OFF VALVE.—Michael J. Heaphy, Brooklyn, N. Y. This is a sliding valve containing a rotary valve having a recess, a pinion with a shaft being loosely mounted in the rotary valve, while a projection on the shaft is located in the recess and movable therein and a rack engages the pinion, whereby the steam is admitted to and cut off from the cylinder at the ends of the stroke, and the passage of steam is automatically regulated by the governor.

Railway Appliances.

HAND CAR.—Thomas S. Barwis, Arthabaskaville, Quebec, Canada. A transverse crank shaft is journaled under the platform and connected with an upwardly projecting lever, while a longitudinally extending lever is pivoted on the under side of the platform, and also pivoted to the upwardly projecting lever above the crank, gearing connecting the crank shaft with car axle, the lever and crank being never left on the dead center, and the car being run by moving the lever back and forth with a rising and falling movement.

Mechanical.

ROTARY PLANING MACHINE.—Victor V. Lawrence, Waterford, Vt. Combined with the rotary cutter head are slotted arms journaled on the same axis, the presser bar having an inclined cutter seat on its lower side, clamp screws securing the cutter adjustably to the arms, while the presser bar may be adjusted toward or from the cutter head as required.

WATER MOTOR.—Hugo A. Strong, New York City. This is a mechanism for utilizing the force of the currents of a body of water or of a stream, in which a float is employed with a laterally extending frame having horizontal water wheels connected together by intermediate gearing, the driving shaft connecting the water wheels being utilized in any desired way by a suitable connection to drive a mechanism on land.

COMBINATION WRENCH.—Fred J. Pratt and John H. Lane, Jackson, Mich. This wrench has an auxiliary pair of automatic gripping jaws eccentrically pivoted in a socket having a lateral opening and tapering sides adapted to close the jaws, a vertical central tapering rib being located between the shanks of the jaws to open them, the wrench embodying also a screwdriver and a grip for holding and manipulating a wire, being especially adapted for use with bicycles.

MACHINE FOR GRINDING AND POLISHING RIFLE BARRELS.—Orlando M. Grimes, New Haven, Conn. The frame of the machine has opposite front and rear standards in which are journaled parallel transverse shafts, a buffing roller on one and a grinding roller on the other, upward extending levers engaging the opposite ends of both roller shafts, while a transverse shaft connects the lower ends of each pair of levers, and a longitudinal shaft has cams for operating the two connecting shafts, the machine being designed to save hand labor.

MAKING HEEL SCRAPERS FOR PLOWS.—Henry D. Terrell, Conyers, Ga. This invention covers a method of making sharpened bent scrapers, consisting in first rolling the steel bar with a bevel on its one side to give it a sharpened edge, then heating the bar in the center of its length and bending it to the required shape, whereby a cheaper and better scraper can be made, with its temper preserved at each end.

LOOPING MACHINE ATTACHMENT.—Raymond E. Ellenwood, Cohoes, N. Y. This is an attachment for removing the surplus material above the impaling needles in uniting knit fabrics by the looping machine, and comprises a pair of vertically movable tongs, rocked by a rotary cam, with means for closing the tongs, and a positive connection between the cam and the tongs for raising and lowering the latter.

Miscellaneous.

MEASURING VESSEL.—John Freytag, Dayton, Ohio. This invention covers an apparatus for conveniently measuring fluids by a series of vessels each holding a specific quantity conveniently arranged in a case, and all of which have in common an influent and an effluent pipe, the invention also covering a special form of stop cock adapted to the purpose.

PIPE HOLDER.—Patrick McCauley, Braddock, Pa. This invention relates to tools used by plumbers and other artisans, for holding lead pipes in place while operating on them, and has a frame to which calipers are detachably secured forming legs, and a vise at each end of the frame, whereby one, two, or more pipes and faucets can be held in any desired position while forming joints between the several parts.

BOILER.—William H. Byram and John Redman, Fishkill Landing, N. Y. This is a boiler for heating buildings, the invention being an improvement on an invention formerly patented by one of the patentees, alternately arranged partitions being fixed within the horizontal tubes, whereby a more effective circulation will be obtained and an increase of heating surface for the tubes.

ELEVATOR ATTACHMENT.—James Cowie, Leisenring, Pa. This is a safety attachment to prevent accident from overwinding of the cage-suspending rope, there being springs connected to the guides having shoulders, with outwardly extending threaded shanks connected to the springs, and nuts which engage the shanks, so that the downward movement of the cage, on the breaking of the rope, would be checked by the springs.

WIRE STRETCHER.—William G. Frost, Lebanon, Ind. This stretcher consists of a horizontal frame with means at one end for securing the end of a fence wire, and a pulley at the other end with a pawl and ratchet wheel for operating it, and lateral projections with means for securing brace wires thereto, the stretcher being one which may be made a permanent fixture with a wire fence.

FODDER CUTTER.—Philip Meyer and William Schrage, Sheboygan, Wis. This is a machine for cutting hay, straw, corn stalks, etc., and is readily adjustable to throw its feed roll or rolls into and out of gear at the will of the operator, to avoid accidents and to give the cutter head a chance to clean itself, or to allow the feeding of material to it by hand if desired, whereby the operator has complete and easy control of the machine.

FENCE.—James Higgins and John Sullivan, Grand Rapids, Mich. The posts of this fence are made with a face plate and a flange having an upper slot, a wire being stretched along the posts in their flange slots, and a guard rail clamped to the wire between and abutting adjacent posts, making a fence especially adapted for stock farms along railways, and constructed to prevent injury to animals.

KITE CORD STICK.—Charles Schultze, New York City. This is a stick with a body portion to receive the cord, and handles axially in line with the stick body, on which the body is journaled, in a manner to allow the cord to be freely wound up, and to be paid out easily by the pull of the kite, without danger of hurting the hands or of letting the stick slip from the grasp.

BODY BRACE.—James D. McKinney, Mossy Creek, Ga. This is a brace for the use of gardeners, cotton pickers, etc., whose occupation requires them to stoop, and consists of a fulcrum pad adapted to bear upon the pelvis, with springs extending down behind the legs, and a spring extending up and connected to the arms or shoulders, thus relieving the muscles of the back, loins, and thigh.

OYSTER PAIL.—John P. Kuhn and James A. Reynolds, Alton, Ill. This invention covers a special construction of pail in which the cover is secured by a looped and hinged hasp, and in a recess in the top of the cover is a spring tag holder. The invention formed the subject of an illustrated notice in our issue of July 13.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1037) R. R. S. asks: Is there a new cement for floors, such as those in conservatories? We read of one made of plaster, then treated with some chemical which oxidizes and then becomes a rich mahogany color. A. Mix six parts of plaster of Paris with one of lime; wet, slake and lay the floor. Then go over it after it is dry with a solution of copperas. This is repeated several times. The surface must be perfectly dry before each application. Finally, after some days' drying, brown with boiled linseed oil and finally varnish with copal varnish. The floor may have to be laid in sections on account of the expansion on setting. The iron oxide turns brown on exposure to the air.

(1038) M. C. M. asks when the dark ages began, as we cannot settle that question satisfactorily. A. It cannot be settled satisfactorily. The term is applied by various authors differently, whether justly or not to any period of European history is a matter of opinion. Some say they began in the 5th century, others as late as the 8th century.

(1039) S. S. B. writes: Can you tell me what metals are the most susceptible to heat or cold, and the most expansive, and if cast or wrought? A. Of the common metals, zinc is the most expansive; it akes little difference whether rolled or cast.

(1040) J. W. asks: What is put on crayon and lead pencil drawings so that the pencil marks will not rub out? A. To 1 part dammar varnish add 25 parts of turpentine. Flow the drawings with this and let them dry. Or use skimmed milk and water mixed in equal parts, applied with a brush.

(1041) S. W. S. writes: 1. Is linseed oil of benefit to shingle roofs? A. Yes. 2. Does it affect the water from roofs to which the oil has been applied? A. Use raw oil, and it will soon be so completely absorbed and dried as not to affect the water. 3. Is there any paint that may be applied to shingle roofs without risk of affecting the water from such roofs, if used for drinking? A. Iron oxide paint, often called metallic paint, is innocuous, and may be used. The same is to be said for the ochers, but we should not advise lead or zinc, as there would be some risk of poisoning.

(1042) North Carolina.—For treatment of gold ores, etc., we refer you to "The Metallurgy of Gold," by Eissler, price $3; "Elements of Metallurgy," by Phillips, $9.

(1043) J. A. R. asks: Please give a formula and directions for making magic lantern slides from photo. negatives. A. We refer you to page 33, January 15, 1887, issue of the SCIENTIFIC AMERICAN.

(1044) M. A. G. asks what the stationary temperature is at 50 to 80 feet below the surface of the earth. Also would the temperature be the same say at 1,000 feet below the surface, whether we begin our measurement from the top of a mountain or high table land or from near sea level? A. The mean plane of uniform subterranean temperature varies from 50 to 80 feet in depth in different parts of the earth. The variation is probably due to difference in conductivity of the soil or rock. The temperature of this plane is also a variable governed by the mean temperature for different latitudes or localities, the mean for middle latitudes being 50°. At 1,000 feet depth, plains and table lands would have nearly the same temperature, the variation being due to variable condition of rocks or soil. In steep mountain regions not affected by volcanic action, the increase of temperature will be at a less rate than the mean of 64 feet for each degree of increase. Actual trials have made the variation range from 47 feet to 70 feet in depth for each degree of increase in temperature.

(1045) G. B. L. asks (1) the cause of foaming in a boiler. A. Foaming in a boiler may be caused by dirty water or by driving the boiler for more steam than is due to its size. 2. The best way to prevent it. A. Clear the water by blowing off or cleaning the boiler if necessary. 3. What is the greatest danger from foaming? A. The greatest danger is with the engine cylinder heads, which are liable to be broken by the water carried over. 4. Is there any way to smooth a box or shaft that has cut, such as the shaft and crank pin of an engine? A. Only by smoothing down the raised parts or ridges with a fine file to the level of the original surface. 5. What is the best thing to put into a boiler to remove scales? A. There are a variety of scale cleaning chemicals adapted to the kinds of material forming the scale. Carbonate of soda and caustic soda are much used.

(1046) P. E. asks: 1. Why has an injector an overflow? Could water pressure be used instead of steam in an injector, if not, why? A. The overflow is for the purpose of starting the injector. Water is not used as a power in operating an injector as used for boiler feeding, as it has not sufficient power at ordinary pressures. 2. The difference between a direct and indirect acting engine. A. Direct engines have cylinder and shaft center in the same line. Beam engines are indirect. 3. Is there any practical way to find the power required to run a mill in order to find the size of engine? A. Yes. Ascertain from builders of machines or by comparison with like machines already running, the power required for each machine, to which should be added the computed power for all the shafting and belts. Much of this information is derived from the experience of mechanical engineers and some from books on the friction of machinery. See Nystrom's and Haswell's Engineer's Pocket Book, which we mail for $3.50 and $4 each. 4. What is the rule with regard to the number and size of stays in steam boilers? A. For the construction and laying out of boiler stays see Boiler Maker's Pocket Book, by M. J. Sexton, which we mail for $2.00. 5. How are large guns bored and rifled? A. Cannon are bored by revolving on a stationary drill, followed by a cutter bar. The rifling is done by pushing a cutter down the bore, the bar being grooved with the proper twist and run through a nut. 6. Is there a simple rule to find how to divide any circle into any number of equal parts, such as laying off holes in a cylinder head? A. There is no more practical way of laying out cylinder heads or flanges for bolt holes than the dividers on a scratched circle. 7. What is the candle power of an ordinary street arc electric light and the power required to produce it? A. Arc lights vary very much in intensity; average less than 1,000 candle power.

(1047) G. A. D. asks: 1. What substance, if any, if the light of the sun be passed through it, will keep back all the rays except the ultra violet rays and allow these to pass through? A. Pass the sun's rays through a prism. Cut off with a screen all the visible part. The ultra violet part will then be left active although unaccompanied by light. 2. What substance will under the same circumstances, keep back all the rays of the spectrum except the red and allow these to pass through? A. Solution of iodine in bisulphide of carbon. 3. Can ultra violet or red rays of light be obtained from other sources of light, such as lamp flames, gas flames, etc., or only from the light of the heavenly bodies? If there are other sources please name a few. A. Ultra-violet rays exist in abundance in the magnesium light and in the electric arc light, also to some extent in almost all sources of light. The red rays exist in all sources of light in considerable proportion. 4. Is it possible to collect, say for instance the red rays through a lens, and will this intensify them? A. It is possible by using the iodine solution, and a lens will concentrate them.

(1048) W. F. asks the process of etching brass for signs. A. Paint the sign with asphalt varnish, leaving the parts to be etched unpainted, raise a border around the outside, made of soft beeswax or asphalt, to hold the acid. Use nitric acid diluted with five times the quantity of water. Pour the dilute acid on to the sign about one-quarter inch deep. When the letters are cut deep enough, which must be found by trial, the acid may be poured off and the plate cleaned by heating and wiping, and finally with turpentine.

(1049) W. M. H. asks: 1. Is the perturbation of the waters in Kinnersley's thermometer due to the pressure of the spark of electricity in air above the water, or to the direction of the electrical current? A. The movement of the water is caused by the displacement of air by the electric spark, the reaction taking place instantly. With a continuous flow as from a point the displacement is permanent during the flow. 2. Why does a T cut in paper and looked at through a pin hole in a second piece of paper held close to the

eye appear inverted? A. Because the hole acts as a lens or camera and inverts the image independent of the eye image. 3. Why does the united attraction of the planets on the earth's equatorial belt have an opposite effect on the equinoxes to that produced by the sun and moon? A. We do not know that the action of the planets have an opposite effect upon the equinoxes to that of the sun and moon. There is nothing in the theory that suggests a difference of attractive force.

(1050) H. P. F.—You cannot, with any degree of practical success, draw water 40 feet high. You can ordinarily draw it to advantage only about 20 to 25 feet, and must force it the balance of the height for much greater distances, for which you will need a deep well pump in which the bucket and valves are located near or beneath the water level.

(1051) C. H. S. asks: 1. Can a locomotive be run faster jacked up than on the rails, and if so, why? A. Yes, because it is capable of running faster than the danger speed upon the rail. 2. Could a locomotive be run so fast that there would be danger from centrifugal force or breaking the parallel rods, and what rate of speed per mile would the driving wheels be turning at? A. Probably, if all parts were perfect. Possibly a rate of one hundred or more miles per minute might be attained by the wheels of a good locomotive jacked up.

(1052) G. G.—United States regulations allow 100 cubic feet measurement to a ton. There is considerable variation in the proportion of registered tonnage to stowage, in the different forms of ships, from something less than the registered tonnage to 30 per cent more. See Haswell's "Engineer's Pocket Book" for forms and tonnage of vessels. We can mail it for the price, $4.

(1053) G. J. E. asks: 1. Is there anything known to chemists that will destroy ticks on cattle without injury to the animal? A. Try a mixture of benzine 10 parts, water 85 parts, soap 5 parts. Keep the benzine away from fire, as it highly combustible. Or mix by heat, common soap with water and crude carbolic acid and apply to the cattle. The Department of Agriculture, Washington, D. C., may be addressed on such points. 2. How can sulphur be dissolved for putting on stock or in their water? A. No practical way of doing this is known as regards internal administration. The following formula is given for sulphur soap: ½ pound new white curd or Castile soap, 1 ounce flowers of sulphur, 1 fluid ounce alcohol, mixed together. For sulphur ointment, 1 part of flowers of sulphur are mixed with 3 to 4 parts lard. For alkaline sulphur ointment mix flowers of sulphur 20 parts, carbonate of potash 10 parts, water 5 parts, lard 65 parts.

(1054) W. A. H. asks: 1. Do you know any use for pine slabs other than fuel? Is there anything in the architectural ornament or furniture line into which they could be turned using a Weymouth or jackknife lathe? A. It much depends upon the size of the pine slabs as to the possibility of utilizing them. If large enough they could be milled into mouldings of various kinds for house trimming or into laths. 2. Will you state the chemical difference between asbestos, soapstone and agolite. The latter is a porous rock found in Northern New York. I believe it is sometimes called talc. A. Talc, soapstone, steatite, rensaelerite and their varieties are hydrous silicates of magnesia, with traces of iron, alumina, and potash that go to make a chemical variety in proportions designating their various names and forms. Asbestos is a silicate of magnesia and lime, with traces of iron, alumina, and manganese. The chemical variations of its composition give it the variety of forms in which it is found. 3. Is there any solvent for asbestos, and if so, what is it? A. As silicon forms about 60 per cent of the combination in asbestos, hydrofluoric acid only will destroy, and by dissolving disintegrate. See Dana's Mineralogy, which we can mail for $3.50. 4. Do you know any material which could be used to coat an iron rotary pump, with which to make it withstand weak bleach liquor? A. We know of no material that will save the internal surface of an iron pump from the action of chlorine bleaching liquor.

(1055) E. A. B.—The centrifugal force derived from the moon's motion in its orbit is exactly counterbalanced by the attraction of the earth, so that there can be no just reason for an atmosphere on the side of the moon away from us, as you suggest.

(1056) G. B. asks: 1. Where does the touch hole as it is called belong in a cannon? A. Just forward of the bottom of the bore. 2. How is a cannon fired by percussion caps or fuses, and how are they made? A. There are various kinds of hammers usually attached to the gun for firing. The caps for cannon are made with a tail piece to slip into the touch hole to keep the cap in place. They look like a button with a small tube in the center.

(1057) J. P. A. asks how to caseharden a piece of iron which is rather thin, without bending or twisting it. A. The bending or warping may, as far as possible, be prevented by dipping the piece edgewise or endwise to harden, or so that the water touches both sides at the same instant. For other particulars about casehardening, see SUPPLEMENT, No. 23.

(1058) D. G. C.—There is no difference in pressure per square inch or square foot due to difference in the horizontal size of tanks or reservoirs. Height of the surface above the orifice gives the measure of pressure, which for water is 0·43 of a pound for each foot in height.

(1059) P. M.—The alloy mixtures of copper, tin, lead, zinc, and antimony cannot be separated by any known flux nor by any melting process.

(1060) J. G. asks a receipt for applying a patent leather finish on black leather belts and boxes, or some good substitute for patent leather finish. A. You cannot get a permanent patent leather finish except by japanning the leather in an oven, as it is made. The following receipt, if rightly used, will make a fair substitute: Dissolve half a pound of ruby shellac in a quart of 95 per cent alcohol, closing the flask and keeping in a warm place for two or three days, then add an ounce of dry Castile soap dissolved in half a pint of warm alcohol with 1½ ounces glycerine. After this add 1½ drachms aniline black soluble in one gill of alcohol, letting the whole mixture stand for several days before using. Two or three coats of this may be applied, always letting one coat thoroughly dry before another is applied.

(1061) W. C. T.—Copperas is not used as a paint for preventing rust on steel. Steel that is clean can be dipped in a solution of sulphate of copper in water boiling hot and rinsed in clean hot water. It will then have a thin coat of copper upon the surface that prevents rust. For preserving burnished brass, varnish with a thin lacquer made with shellac and alcohol.

(1062) V. E. M.—The form of the Eiffel tower provides for any movement of the whole of its various members by variation in temperature. The Brooklyn bridge is made in four distinct sections lineally. The cables rise and fall, and the line sections slide at the centers. There is about 2½ inches in this movement at the center of the bridge from winter to summer.

(1063) W. C. asks for the ingredients used to color tin blue, as in tin boxes, cans, etc., or any one of these colors, the simplest to compound in lacquer paint, namely, blue, yellow, or pink. A. As a base use varnish prepared from shellac ¾ pound, gum sandarac 3¼ ounces, alcohol 2 gallons. Color to suit either with aniline colors or use Prussian blue, carmine red, or gamboge yellow and other transparent colors and obtain the desired tints by trial.

(1064) T. L.—For treatment of the hair we refer you to our SUPPLEMENT, Nos. 388, 173, 102, 396.

NEW BOOKS AND PUBLICATIONS.

A PRACTICAL TREATISE ON THE MANUFACTURE OF BRICKS, TILES, TERRA COTTA, ETC. Comprising every important product of clay employed in architecture, engineering, the blast furnace, for retorts, etc., with a history and the actual processes in handling, disintegrating, tempering, and moulding clay into shape, including full detailed description of the most modern machines, tools, kilns, and kiln roofs used. By Charles Thomas Davis. Second edition, thoroughly revised. Illustrated by 217 engravings. Pp. 501. Philadelphia: Henry Carey Baird & Co.; London: Sampson Low, Marston, Searle & Rivington, Limited. 1889. Price $5.

This is a new and greatly revised edition of a book which, when first published in 1884, was the only treatise on these important industries which had then appeared in this country. This is the more remarkable, as the manufacture of bricks in the United States is conducted on a more extended scale, and has developed a greater degree of mechanical ingenuity, than is to be found, in this industry, in any other country in the world. It is one of the grand results of the well paid labor of this country that not only is that labor more intelligent, but that its high rate of remuneration induces the introduction of machinery by means of which that labor becomes more efficient. Thus is it that not only is this machinery rendered necessary by the price of labor, but the capacity for the creation of the machinery is developed by the amelioration of the condition and the intellectual growth of the workers who conduct our diversified industries. The treatise of Mr. Davis covers the industries of which it treats in a very complete, thorough, and particular manner. The practical operations are most fully and intelligently given; the raw materials and their various qualities, modes of treatment and localities, are well presented, while examples of the newest and best machinery are given and illustrated by engravings. On the whole, it is an admirable view of the present state of one of the most advanced of American industries. One of the special features of the present edition is the increased consideration given to fire clays and fire brick. The volume is admirably illustrated and beautifully printed on fine paper, and its value is much increased by good examples of those splendid tables of contents and indexes on which Messrs. Henry Carey Baird & Co. so justly pride themselves—never publishing a book without furnishing the reader with the means of easily finding access to any subject which is treated in it.

THE A B C OF ELECTRICITY. By Wm. H. Meadowcroft. New York: Frank F. Lovell & Co. Pp. 108. Price 50 cents.

The title of this work tells what it is—a statement of the elementary laws of electricity. They are given in a popular and graphic form, and are especially adapted for those not conversant with the alphabet of the science. One feature to be noticed is that the text is devoted to the practical science of electricity; the author starts with the practical units, and throughout adheres to the everyday, useful portion of the science, leaving the theoretical part aside as not needed by the working electrician. For these reasons the book is to be welcomed as an addition to the literature of the science.

THE PROSPECTOR'S HAND-BOOK: A GUIDE FOR THE PROSPECTOR AND TRAVELER IN SEARCH OF METAL BEARING OR OTHER VALUABLE MINERALS. By J. W. Anderson, M.A., F.G.S. London: Crosby Lockwood & Son. 1887. Pp. xii, 145. Price $1.50.

The art of prospecting is to be learned only from field work. But theoretical knowledge is also essential to the prospector's complete intellectual outfit. Midway between theory and practice is an important ground which is covered by this book. The identification of minerals, practical hints on looking for outcrops of value, notes on assaying, and a quantity of other valuable matter are given. With this book in hand a prospector will not necessarily find a gold mine, but he will run far less risk of making the opposite mistake, and assume a lump of iron pyrites to be a nugget of gold or flakes of yellow mica to be the veritable golden sand. The difficulty of giving enough and not too much seems to have been successfully overcome.

CERCLE CHROMATIQUE. By M. Charles Henry. Paris: Charles Vadin. 1888. Pp. 168.

The author has in this work set himself a somewhat ambitious task of reducing to system the consideration, experimental and theoretical, of the more subjective aspects of sound and color. The work is one which will doubtless prove of interest to physico-biologists.

RAPPORTEUR ESTHETIQUE. By M. Charles Henry. Paris: G. Seguin. 1888. Pp. 23.

The graphic rectification of all form in an æsthetic sense are set forth by the author, who appears in some senses a disciple of Dr. Brown-Sequard. It is largely on the lines of the preceding work, and is introductory to the use of an apparatus for developing æsthetic relations, also due to the author.

☞Any of the above books may be purchased through this office. Send for new book catalogue just published.

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July 9, 1889,

AND EACH BEARING THAT DATE.

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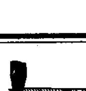

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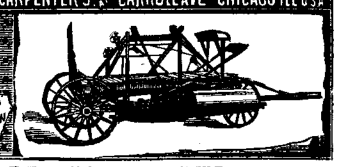

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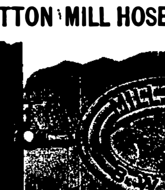

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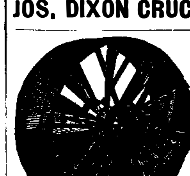

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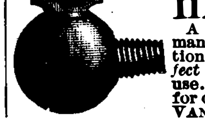

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Proposals for Construction of Abutment of Dam No. 1, Cumberland River.—ENGINEER OFFICE, U. S. ARMY, Nashville, Tenn., *July* 5, 1889.—Sealed proposals, in triplicate, will be received at this office until 11 A. M., Tuesday, August 6, 1889, for Building Coffer-dam, Excavating for Foundation, and Construction of Stone Abutment at Dam No. 1, Cumberland River, near Nashville, Tennessee. Bidders are invited to be present at opening of the bids. The United States reserves the right to reject any and all proposals. The attention of bidders is invited to the Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 24, page 414, Statutes at Large. Specifications and blank forms for proposals will be furnished on application at this office.

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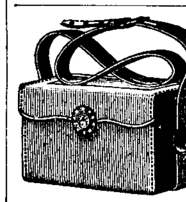

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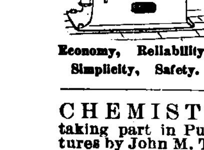

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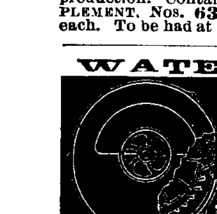

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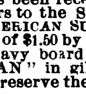

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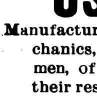

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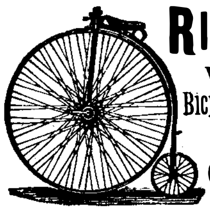

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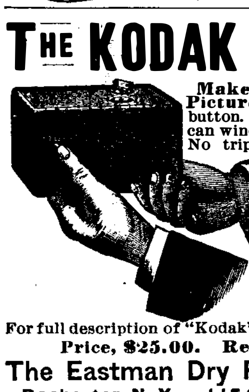

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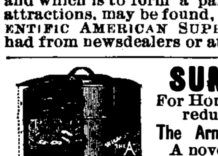

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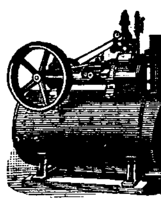

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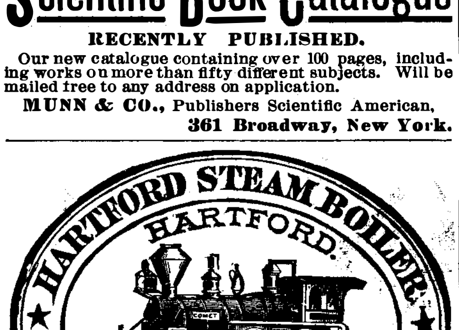

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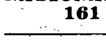

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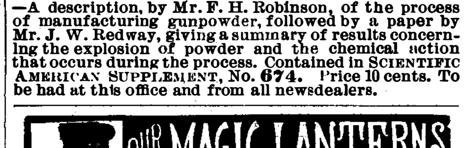

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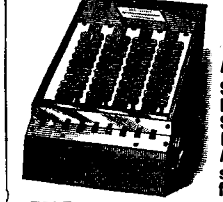

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